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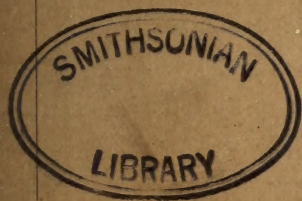
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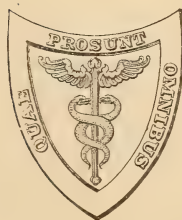
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A Treatise on the Principles and Practice of Medicine. By AUSTIN FLINT, M.D., LL.D., late Professor of the Principles and Practice of Medicine and of Clinical Medicine in Bellevue Hospital Medical College, New York, etc. Assisted by WILLIAM H. WELCH, M.D., Professor of Pathology in Johns Hopkins University, Baltimore, and AUSTIN FLINT, M.D., LL.D., Professor of Physiology in the Bellevue Hospital Medical College, New York. Sixth edition. Philadelphia : Lea Brothers & Co., 1886.

A Manual of Obstetrics. By A. F. A. KING, A.M., M.D., Professor of Obstetrics and Diseases of Women and Children in the Medical Department of the Columbian University, Washington, D. C., and in the University of Vermont. Philadelphia : Lea Brothers & Co., 1886.

Manual of Physiology. A Text-Book for Students of Medicine. By GERALD F. YEO, M.D., F.R.C.S., Professor of Physiology in King's College, London, etc. Second American edition. Philadelphia : P. Blakiston, Son & Co., 1886.

A Text-Book of Human Physiology, including Histology and Microscopical Anatomy, with Special Reference to the Requirements of Practical Medicine. By DR. L. LANDOIS, Professor of Physiology and Director of the Physiological Institute, University of Greifswald. Second American, translated from the fifth German edition. With additions. By WILLIAM STIRLING, M.D., Sc.D., Brackenbury Professor of Physiology and Histology in Owens College and Victoria University, Manchester. Philadelphia : P. Blakiston, Son & Co., 1886.

The Curability of Insanity. A Series of Studies. By PLINY EARLE, A.M., M.D., late Superintendent of the State Lunatic Hospital at Northampton Mass. Philadelphia : J. B. Lippincott Co., 1887.

A Treatise on the Practice of Medicine, for the Use of Students and Practitioners of Medicine. By ROBERTS BARTHOW, M.A., M.D., LL.D., Professor of Materia Medica, General Therapeutics, and Hygiene, in the Jefferson Medical College of Philadelphia. Sixth edition. New York : D. Appleton & Co., 1886.

Paralyses, Cerebral, Bulbar, and Spinal. A Manual of Diagnosis for Students and Practitioners. By H. CHARLTON BASTIAN, M.D., F.R.S. New York : D. Appleton & Co., 1886.

Outlines of the Pathology and Treatment of Syphilis and Allied Venereal Diseases. By HERMANN VON ZEISS, M.D., late Professor at the Imperial Royal University at Vienna. Second edition, revised. By MAXIMILIAN VON ZEISSL, M.D. Authorized edition. Translated, with Notes, by H. RAPHAEL, M.D., Attending Physician for Diseases of the Genito-Urinary Organs and Syphilis, Bellevue Hospital, Out-patient Department. New York : D. Appleton & Co., 1886.

How We Treat Wounds To-day : A Treatise on the subject of Antiseptic Surgery which can be Understood by Beginners. By ROBERT T. MORRIS, M.D., late House Surgeon to Bellevue Hospital, New York. Second edition. New York and London : G. P. Putnam's Sons, 1886.

Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and Subjects. Vol. VII. Washington, 1886.

Handbook of Zoölogy. With Examples from Canadian Species, Recent and Fossil. By SIR J. WILLIAM DAWSON, LL.D., F.R.R.S., etc. Third edition. Montreal, 1886.

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The Medical Profession in Ireland, and its Work. By E. D. MAPOTHER, M.D., Consulting Medical Officer of Health for Dublin. Dublin, 1886.

Three Lectures Delivered at the Hospital for Sick Children. By ROBERT G. LEE, M.D., F.R.C.P. Lectures I., II. On the Transmission of Syphilis; with Cases arranged to Illustrate the Relations between the various Symptoms of Hereditary Syphilis in Children, and the Parental History. Lecture III. On the Earliest Record of Whooping-Cough. London, 1886.

Du Délire Chez les Dégénérés. Observations Prises a L'Asile Sainte-Anne 1885-1886 (service de M. Magnan). Par le DR. M. LEGRAIN, Ancien interne des asiles d'aliénés de la Seine. Ancien externe des hôpitaux. Paris: A. Delahaye et E. Lecrosnier, 1886.

Du Traitement des Phenomenes Dououreux de l'Ataxie Locomotrice Progressive par Pulverisations d'Ether et de Chlorure de Methyle. Par A. G. RAISON. Paris, 1886.

Handbuch der Physiologischen Optik. Von H. VON HELMHOLTZ. Zweite umgearbeitete Auflage. Dritte Lieferung. 1886.

Die künstliche Beschränkung des Kinderzahl als sittliche Pflicht. Von HANS FERDY. Zweite Auflage. Berlin, 1886.

Die Mittel zur Verhütung der Conception, nebst einem Versuche zur kritischen Entscheidung eines streitigen Punktes der Conceptionstheorie. Von HANS FERDY. Berlin, 1886.

Zur medicinischen Statistik. Von J. APELLA. Berlin, 1886.

Die Brasdor'sche Operation bei Aneurysmen des Arcus Aorta und der Anonyma. Von DR. JUL. ROSENSTIRN.

Medical Education and Medical Colleges in the United States and Canada, 1765-1886. Illinois State Board of Health. Springfield, Ill.

The Action of Microorganisms upon Surgical Wounds, with Demonstrations. By FREDERIC S. DENNIS, M.D., Professor of the Principles and Practice of Surgery, Bellevue Hospital Medical College, New York City.

Cases in Orthopædic Surgery. By AP-MORGAN VANCE, M.D. Louisville, Ky., 1886.

Temperature of the Body in Health and Disease. By H. HATHAWAY. M.D. Toledo.

A Case of Pregnancy Complicated with Uterine Fibroids and Measles. By D. W. CATHELL, M.D., Baltimore, Md.

Meconeuropathia. By C. W. HUGHES, M.D. St. Louis, Mo., 1886.

The Curette as a Diagnostic and Therapeutic Agent in Gynecology and Obstetrics. By B. BERNARD BROWN, M.D., Professor of Diseases of Women in the Woman's Medical College of Baltimore. Baltimore, Md., 1886.

Fibro- or Spindle-celled Sarcomatous Tumors, with the Report of a Case, and Presentation of the Specimen. By B. A. WATSON, A.M., M.D., Surgeon to Charity, St. Francis, and Christ Hospitals, Jersey City, N. J. Chicago, 1886.

The Surgery of the Pancreas, as Based upon Experiments and Clinical Researches. By N. SENN, M.D., of Milwaukee, Wis., Attending Surgeon to Milwaukee Hospital. Philadelphia, 1886.

Method in Medical Study. By CHARLES H. MAYS, M.D., Instructor in Ophthalmology, New York Polyclinic. 1886.

The Exploration, Excavation, and Illumination of the Interior of Bones in any Part of the Body. By MILTON JOSIAH ROBERTS, M.D., Professor of Orthopædic Surgery and Mechanical Therapeutics in the New York Post-Graduate Medical School and Hospital.

The Human Color-Sense Considered as the Organic Response to Natural Stimuli. By L. WEBSTER FOX, M.D., and GEORGE M. GOULD, A. B.

Puerperal Eclampsia. By GEORGE W. MILTENBERGER, M.D., Professor of Obstetrics, University of Maryland. 1886.

Hypertrophic Nasal Catarrh. By A. B. THRASHER, M.D., Physician to Medical Dispensary, Medical College of Ohio.

A Case of Convergent Squint, Associated with Myopia of High Grade. Tenotomy of both Recti Interni Muscles. Restoration of Binocular Vision, The Divided Muscles still Retaining a Preponderance of Power. By SAMUEL THEOBALD, M.D., Surgeon to the Baltimore Eye, Ear, and Throat Charity Hospital.

Malarial Hæmoglobinuria. By H. McHARTON, Macon, Ga.

Report on Classification of Mental Diseases as a Basis of International Statistics of the Insane, made to the Belgian Society of Mental Medicine. By CLARK BELL, Esq., International Delegate for North America.

Two Rare Cases of Abdominal Injury. By S. C. STUCKY, M.D., Lexington, Ky.

The Sanitary Condition of Harrisburg, Pa. By HUGH HAMILTON, M.Sc., M.D., Harrisburg, 1886.

A System of Case Records. Arranged by REYNOLD W. WILCOX, M.A., M.D., Instructor in Clinical Medicine in the New York Post-Graduate Medical School.

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Is Electrolysis a Failure in the Treatment of Urethral Strictures? By ROBERT NEWMAN, M.D. New York, 1886.

- Observations on the Administration of Chloroform. By T. J. SULLIVAN, M.D., Ann Arbor.
- A Case of Atresia of the Vagina and Division of the Urethra and Base of the Bladder. By T. J. SULLIVAN, M.D., Ann Arbor.
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- Some Recent Experiences in Clinical Surgery. Illustrated by Notes of Cases, Pathological Specimens, and Patients. By DONALD MACLEAN, M.D.
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- On Toxic Urine in Relation to Certain Surgical Operations on the Urinary Organs. By REGINALD HARRISON, F.R.C.S., Surgeon to the Liverpool Royal Infirmary.
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- Report on Rhinology. The Treatment of Nasal and Pharyngo-Nasal Catarrh. By J. ADDISON STUCKY, M.D., Lexington, Ky.
- Venous Blood Tumors of the Cranium in Communication with the Intracranial Venous Circulation, especially the Sinuses of the Dura Mater. By WM. M. MASTIN, M.D., of Mobile. Chicago, 1886.
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- Address in State Medicine. By JOHN H. RAUCH, M.D., of Illinois, Chairman of the Section of State Medicine, Chicago, 1886.
- In Memoriam: Austin Flint, M.D., LL.D., James Marion Sims, M.D., LL.D. By WESLEY M. CARPENTER, M.D.
- Report on Surgery. By G. L. SIMMONS, M.D. Sacramento, 1886.
- Galvanocautery in Diseases of the Prostate, Bladder, and Urethra. By ROBERT NEWMAN, M.D., of New York. Chicago, 1886.
- On the Employment of Thallin in Febrile Affections. By J. P. CROZER GRIFFITH, M.D., Assistant to the Professor of Clinical Medicine in the University of Pennsylvania.
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- Principles of Hygiene for the School and the Home, together with so much of Anatomy and Physiology as is necessary to the Correct Teaching of the Subject. By EZRA M. HUNT, A.M., M.D., Sc.D., Secretary of the State Board of Health of New Jersey. New York and Chicago: Ivison, Blakeman, Taylor & Co., 1886.
- Transactions of the Texas State Medical Association, April, 1886. Austin, 1886.
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- Transactions of the New Hampshire Medical Society at the Ninety-sixth Session, held at Concord, June, 1886. Manchester, N. H., 1886.
- Transactions of the Medical and Chirurgical Faculty of Maryland. Baltimore, 1886.

Transactions of the Medical Association of Missouri. St. Louis, 1886.

Transactions of the Mississippi State Medical Association. Jackson, 1886.

Transactions of the Medical Association of the State of Alabama. The State Board of Health. Session of 1886, Anniston, April 13-16, 1886. Montgomery, Alabama, 1886.

Report of the Board of Health of the State of Rhode Island for 1885; and including the Report upon Births, Marriages, and Deaths, in 1884. Providence, 1886

Report of the State Board of Health and Vital Statistics of the Commonwealth of Pennsylvania. Harrisburg, 1886.

Report of the State Board of Health of Illinois. With an Appendix. Springfield, Ill., 1886.

Report of the State Board of Health of the State of Michigan for 1885. Lansing, 1886.

Report of the State Board of Health of California for 1886. Sacramento, 1886.

Proceedings and Addresses at the Sanitary Convention held at Kalamazoo, Mich., June 1 and 2, 1886, under the direction of a Committee of the State Board of Health. Lansing, 1886.

Annual Report of the Commissioners of Pensions to the Secretary of the Interior for the year ended June 30, 1886. Washington, 1886.

Annual Report of the Alumni Association, with the Exercises of the 65th Commencement of the Philadelphia College of Pharmacy, for the year 1885-1886.

Thirteenth Annual Report of the Maternity Hospital. Philadelphia, Pa., 1886.

The following Journals have been received in exchange :

Albany Medical Annals.	Medical Analectic.
Alienist and Neurologist.	Medical Herald.
American Chemical Journal.	Medical News.
American Druggist.	Medical Press of Western New York.
American Journal of Insanity.	Medical and Surgical Reporter.
American Journal of Obstetrics.	Medical Record.
American Journal of Pharmacy.	Mississippi Valley Medical Monthly.
American Journal of Science.	Nashville Journal of Medicine and Surgery.
American Lancet.	New England Medical Monthly.
American Medical Digest.	New Orleans Medical and Surgical Journal.
American Practitioner.	New York Medical Journal.
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Archives of Ophthalmology.	North Carolina Medical Journal.
Archives of Otology.	Northwestern Lancet.
Archives of Pediatrics.	Obstetric Gazette.
Atlanta Medical and Surgical Journal.	Pacific Medical and Surgical Journal.
Boston Medical and Surgical Journal.	Peoria Medical Monthly.
Buffalo Medical and Surgical Journal.	Philadelphia Medical Times.
Chicago Medical Journal and Examiner.	Physician and Surgeon.
Cincinnati Lancet and Clinic.	Polyclinic.
Cincinnati Medical News.	Popular Science Monthly.
Cleveland Medical Gazette.	Quarterly Compendium of Medical Science.
College and Clinical Record.	Quarterly Journal of Inebriety.
Columbus Medical Journal.	Rocky Mountain Medical Times.
Daniels' Medical Journal.	Sanitarian.
Dental Cosmos.	Sanitary Engineer.
Denver Medical Times.	Sanitary News.
Druggist's Circular.	Southern California Practitioner
Florida Medical and Surgical Journal.	Southern Medical Record.
Fort Wayne Journal of Medical Science.	Southern Practitioner.
Gaillard's Medical Journal.	St. Louis Courier of Medicine.
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Journal of the American Medical Association.	Therapeutic Gazette.
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Kansas City Medical Record.	Western Medical Reporter.
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RUBELLA (RÖTHELN).¹

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WHILE the broad lines separating measles and scarlatina are universally recognized, there has been anything but harmony among writers concerning certain anomalous forms of eruptive fever prevailing from time to time which present mingled characters of the two affections, or which appear to present the features of an independent affection. Ever since the middle of the last century, they have attracted much attention, and while, for the most part, they have been considered as aberrant forms of measles or scarlatina, there can be noticed a constantly recurring disposition to gather together, under a special designation, certain cases prevailing sporadically or epidemically, which seemed to offer peculiarities distinguishing them from these two diseases. According to Emminghaus, de Bergen (*de roseolis*), in 1752, was in favor of separating rötheln from scarlatina and measles.² Selle, in 1780, declared rötheln to be an independent affection. The question was discussed by various writers, among whom were Zeigler (1788), Thompson (Edinburgh, 1800), Fleisch (1804), Strohmeyer, and others. They all, however, described dangerous affections which seem to have been abnormal forms of scarla-

¹ Read at the tenth annual meeting of the American Dermatological Association, August 26, 1886.

² I am indebted to the articles of Emminghaus (*Jahrb. f. Kinderheilk.*, 1870-71, N. F. 4, S. 47, and Gerhardt's *Handbuch f. Kinderkr.*, 1877, B. 2, S. 336), and of Klaatsch (*Zeitsch. f. klin. Med.*, 1885 10, 1), for most of my historical references.

tina, but which differed widely in their symptomatology. In Hufeland and Henle's *Journal* (1812) Heim wrote concerning "the difference between scarlatina, r $\ddot{o}$ theln, and measles." Willan, in his account of *rubeola sine catarrho*, observed that it did not protect from measles. Bateman made it a variety of this disorder, but Maton, in 1815, recognized its independent nature (Squire). In 1818, however, Henle pronounced r $\ddot{o}$ theln a variety of scarlatina.

A number of writers now successively described epidemics of benign macular eruptions, neither measles nor scarlatina, which did not afford protection from these diseases, attacking all alike, but which nearly always appeared when measles or scarlet fever prevailed, or had preceded or followed by short intervals, in localities proximate to where these exanthems were to be found. In 1822, Sch $\ddot{o}$ nlein, for example, noted that in the "Rheinprovinz" measles was rife, beyond the Elbe, scarlet fever, and between these two districts, r $\ddot{o}$ theln. G. v. d. Busche described an epidemic (1841) beginning with measles, at the height of which r $\ddot{o}$ theln appeared, and when this reached its acme scarlatina became active. Gertsema, in Groningen, in 1821, and again in 1834, had seen similar epidemics; likewise Wagner and Paasch (1854). Sch $\ddot{o}$ nlein had tried to harmonize the discordant opinions by regarding r $\ddot{o}$ theln as a disease in which the relations between the skin and mucous membrane were such that when scarlatinal symptoms developed upon the skin the mucous membrane showed those of measles, and *vice vers $\ddot{a}$* .

Gradually, all affections having a red macular eruption and not recognizable as measles or scarlatina, came to be described as r $\ddot{o}$ theln, and great confusion resulted. Some writers, even, were induced to fall back upon the old teaching of the identity of measles and scarlatina. The identity of r $\ddot{o}$ theln seemed quite disproved, especially when Hebra entirely discredited its specific existence, and Wunderlich spoke of r $\ddot{o}$ theln as a synonym for measles. Gelmo,¹ having observed anomalous epidemics in Vienna in 1848, 1851, and 1857, of which the features were most perplexing, concluded that, although eruptive forms, characteristic neither of measles nor of scarlatina, develop during the transitions of epidemics of measles and scarlatina, epidemics of one or the other of these affections grew out of them always; that isolated cases, anomalies of scarlatina or measles, could not justify the establishment of a separate species; and that, finally, no grounds existed for considering r $\ddot{o}$ theln a distinct disease. Kostlein,² as late as 1865, held r $\ddot{o}$ theln to be a variety of measles.

Balfour,³ however, in 1857, regarded r $\ddot{o}$ theln as a special disease, and in 1864 Greve⁴ and Thierfelder⁵ wrote of it. Veale⁶ in 1866,

¹ Jahrb. f. Kinderheilk., Wien, 1858, Bd. I, 152.

³ Edinb. Med. Journ., 1857, p. 718.

⁵ Greifswald Medicinische Beitr $\ddot{a}$ ge, 1864, Bd. ii.

² Wiener med. Presse, 1868, 13

⁴ Lancet, 1864, 566 *et seq.*

⁶ Edinb. Med. Journ., Nov. 1866.

Schwarz¹ in 1868, Oesterreich² in the same year, Mettenheimer,³ Steiner,⁴ and especially Thomas⁵ in 1869, and Emminghaus⁶ in 1870, rapidly followed in a series of able articles that forthwith rescued r  theln from the oblivion in which previous writers had threatened to overwhelm it. In 1870 Murchison⁷ contributed an article upon this subject, since which time many British physicians have devoted attention to it. Among them may be noted Fox,⁸ Liveing,⁹ Cheadle,¹⁰ Squire,¹¹ and Tonge-Smith.¹² In France, until recently, r  theln attracted little attention. Bourneville and Bricon,¹³ it is true, claim that it had long been recognized. Trousseau¹⁴ regarded it as a distinct affection. It has also been considered by Trastour, Longuet, Lubanski,¹⁵ and others. In America, though it is said to have been described by Homans, Sr., in 1845, and by Cotting in 1853 and 1871,¹⁶ it is to the pen of J. Lewis Smith¹⁷ that we owe the first systematic notice of the disease.

A large number of communications have lately appeared in the journals, adding materially to the sum of our knowledge of the disease. The excellent article by Hardaway in Pepper's *System of Medicine* is especially to be commended. Edwards's valuable paper in the *AMERICAN JOURNAL OF THE MEDICAL SCIENCES*¹⁸ gives an extensive bibliography of American writers upon r  theln. Important contributions have also been made by Duhring, Park, Hatfield, Harrison, and others.

Thus the "r  theln question" has only within twenty years assumed a phase that gives hope of its satisfactory solution. The recent stimulus given it, however, threatens again to relegate it to the domain of medical conundrums; for, while earlier writers were disposed to deny that r  theln was anything but aberrant measles or scarlatina, the recent tendency is to assign to it all anomalous cases and epidemics that resemble but do not correspond with these affections. Doubtless many of these are aberrant forms, or, possibly, combinations of measles and scarlatina. The study of r  theln is thus rapidly becoming obscured by fantastic and motley embellishments, and there is reason to fear that the resulting confusion will reawaken the early scepticism concerning it.

DEFINITION.—R  theln (synonyms: German measles; rubeola; rubeola notha; rubeolo sine catarrho; roseola epidemica, etc.) is a specific, exanthematic, contagious disorder, characterized by a period of incubation lasting usually from two to three weeks; a prodromal period varying

¹ Wiener med. Presse, 1868, 13.

² Journ. f. Kinderkr., 1869, 53.

³ Jahrb. f. Kinderh., 5 Jahrg.

⁴ Lancet, 1870, 595.

⁵ Lancet, 1874, 360.

⁶ Ibid.

⁷ Le Prog. M  d., xii, 578.

⁸ Union M  dicale, 1884, No. 7 et seq.

⁹ Boston Med. and Surg. Journ., 1873; and Trans. Internat. M. Cong., London, 1881.

¹⁰ Archives of Dermatology, vol. i.

¹¹ Inaug. Dissert., Leipzig, 1868.

¹² Archiv f. Dermatol. u. Syph., 1869, 237.

¹³ Ibid., 1870-71, N. F. 4, p. 47.

¹⁴ Med. Times, London, 1870, 360.

¹⁵ Trans. Internat. M. Cong., Lond., 1881, iv.

¹⁶ Lancet, 1883, 994.

¹⁷ Clinical Lectures.

¹⁸ October, 1884.

from a scarcely appreciable interval to one day, less commonly two, and very rarely several days; and an eruptive period in which there is an exanthem closely resembling that of measles. A period of desquamation is in most cases wanting, and when present is but feebly developed. During the attack, and frequently preceding the eruption, there occurs almost constantly an enlargement of the cervical, submaxillary, auricular, suboccipital, and sometimes of other glands, which is often painful, but never suppurative. Catarrhal symptoms are absent or but slightly marked. A faucial hyperæmia is almost constant, but is rarely accompanied by pain. Throughout the attack fever is absent in about half of the cases, and when present rarely endures to the end of the second day or exceeds 39° C. (102.2° F.). The attack seldom lasts longer than three or four days, and the patient rarely keeps to his bed. The affection may prevail sporadically or epidemically, and is contagious, though to a less degree than measles. One attack usually confers immunity from subsequent ones, but does not protect from measles or scarlatina, nor do these exanthems confer immunity from rōtheln. Children are usually affected, though adults have no special insusceptibility.

ETIOLOGY—CONTAGION.—Rōtheln never occurs spontaneously, but is not violently contagious—far less so than measles. Steiner,¹ whose conceptions of its characteristics are especially definite, denies that it is at all contagious. V. Nymann² asserts that its contagiousness is almost *nil*. Klaatsch³ considers it not very active. Only one-half in a school of sixty scholars were attacked (Veale). Park⁴ noted that only two-thirds of those exposed to it were attacked.

Tonge-Smith⁵ regards rōtheln as having a not very intense contagiousness, lasting not longer than a week. Thierfelder thought it most contagious during convalescence, and Squire considers it contagious even before the rash and for two or three weeks afterward. While nearly all writers admit its contagiousness, it must be admitted that as yet we know little about the period when the contagion is most active.

AGE AND SEX.—Rōtheln attacks the sexes indifferently. Of 331 cases gathered from various sources, 151 were males and 180 females. The difference here is probably accidental. Infants are not often attacked, though Sholl⁶ reports a case of an infant a few days old, and Roth one of six months. Steiner saw it in a child of eight months. Lewis Smith also had infants among his patients. Seventy-two per cent. of all his cases were between the ages of two and ten years. Tonge-Smith's cases included, in a total of 145, 132 more than fifteen years old. Most observers report adult cases; Seitz⁷ has recorded it in a woman seventy-

¹ Archiv f. Dermatol. u. Syph., 1869, 237.

² Oesterreich, Jahrb. f. Pædiat., N. F. iv. Bd. 2, 123.

³ Zeitschr. f. klin. Med., 1885, 10, 1.

⁴ Chicago Med. Journ. and Exam., 1881, xlii. 130.

⁶ Transact. Med. Soc. Alabama, 1881.

⁵ Lancet, 1883, 994.

⁷ Ziemssen's Cyclop.

three years old. These variations show that the time at which r  theln is most apt to occur is not a question of years, but of exposure and protection. Most reports come from asylums and children's hospitals, where but few adults are exposed. Adults unprotected by attacks of r  theln during childhood probably enjoy no immunity. Kassowitz,¹ however, noted but five adults among his sixty-four cases in private practice.

RELATION TO OTHER ERUPTIVE FEVERS.—It has been urged against the specific identity of r  theln that it tends to prevail with or immediately before or after epidemics of scarlatina or measles. This tendency was especially noted by earlier writers, whose descriptions suggest that they had reference to anomalous forms of measles or scarlatina, quite as often as to r  theln. The same tendency, however, has been observed by those who entertain definite views of the nature of r  theln; but as r  theln is observed quite independently of prevailing epidemics of either of these diseases, it seems probable that these are coincidences without significance, and have an analogue in similar coincident prevalence of other eruptive fevers. It is a point of the greatest importance, however, that, although r  theln often closely corresponds in point of time with measles or scarlatina, the diseases are not mutually protective. Those who have had the latter affections are as susceptible of r  theln as those who have not, and an attack of the last named disorder in no wise lessens the liability to either of the former. This is universally admitted. Of Steiner's 21 cases, 6 had had scarlet fever and measles, and 7 had had measles alone; of Thomas's 23 cases, 12 had had measles, and 3 scarlatina; of 48 cases recorded by Lewis Smith, 19 had had measles, and 1 contracted measles one month subsequently. Dukes² noted 63 cases in 1877, of which 39 had had measles, and 25 cases in 1878, of whom 22 had had measles. Of 19 cases under the observation of Roth,³ 7 had had measles within seven or eight weeks; and Rott⁴ reported 17 cases, of which 16 had already had measles. Of Veale's 30 cases, 13 had had measles. Shuttleworth⁵ noted that of his 31 cases, 11 had already had measles, and 7 measles and scarlatina. Subsequently 2 of these patients had measles, 5 measles and scarlatina, and 2 scarlatina only. Most of Parks's 100 cases had had measles during the previous winter or spring. There is thus abundant evidence that no immunity is afforded by an attack of r  theln against measles and scarlatina, and *vice vers  *. Indeed, the second malady sometimes follows closely upon the heels of the first.

INCUBATION.—This is longer than is usual with the exanthemata, though wide variations are observed. Robinson⁶ determined in his cases

¹ Trans. Internat. Med. Cong., London, 1881, iv. p. 10.

² Lancet, 1881, 745.

³ Deutsch. Archiv f. klin. Med., 14, 539.

⁴ Aertzl. Intelligenz-Blatt, 1879, x. p. 101.

⁵ Transact. Internat. Med. Cong., London, 1881, iv.

⁶ Medical Times and Gazette, 1880.

a period of 6 to 7 days. Bristowe¹ considers incubation to last 1 week; Edwards² about 10 days (shortest incubation 6 days, the longest 21 days); Lewis Smith, from 7 to 21 days; Squire, from 14 days to 3 weeks; Tonge-Smith in 10 cases noted an incubation of 14 days; Dukes, in 36 cases, from 12 to 22 days. Roth estimates it at 18 to 19 days. Klaatsch³ has noted a period of 14 days often, also of 17 to 22 days, and sometimes more than 4 weeks. Thomas⁴ places it from 2½ to 3 weeks, probably never longer, never less. Emminghaus⁵ definitely determined the incubation in most of his cases to be 18 days; in some 14 days, in others as much as 20 days. Veale's cases had an incubation of 12 days. In a series of 30 cases, Balfour noted 14 days as the incubative period; Duckworth⁶ placed it at 16 days; Jacobi,⁷ at 14 to 21 days. A comparison of these figures shows the incubative period of rōtheln more often to exceed than to fall short of 14 days. Some writers place it, definitely, at 18 to 21 days, but general experience appears not to justify such rigid limits. For the present, therefore, we place the incubative period of rōtheln at from 14 to 21 days, sometimes less, rarely more.

PERIOD OF INVASION. PRODRIMAL STAGE.—In many cases, no appreciable prodromal stage is present, the eruption giving the first intimation of disorder. As this is usually observed in the morning, just after the night's rest, it is probable that brief prodromes may have occurred during sleep. Occasionally, prodromes may really be absent, but in the great majority of cases symptoms of slight intensity may be observed from a half to one day before the eruption appears; rarely prodromata last for several days. Steiner has asserted that there is no prodromal stage. Klaatsch and v. Nymann state that the eruption usually appears without prodromes; the latter rarely observed an initial chill 1 or 2 days before the eruption. Thomas asserted that this stage lasts from two hours to a half day at most. Rott observed a prodromal stage of from a half to 1 day; Roth, of from a half to 3 days. Veale's cases showed the eruption on the first day. While Emminghaus often observed no prodromes, he, with Mettenheimer and Thierfelder usually noted them from 1 to 3 days preceding the eruption. Lewis Smith observed them some hours, or a day or even longer; Parks saw no definite premonitory symptoms. Squire saw the eruption on the first day. In Edwards's cases, the average was 3 days; in Hemming's, from a few hours to 3, 4, even 5 days; in Cheadle's, from 2 to 3 days.

These observations show that rōtheln is either without a prodromal stage or has one not exceeding 24 hours in most cases. This characteristic at once stamps the disease with a specific feature. The premonitory

¹ Practice of Medicine.

³ Loc cit.

⁵ Gerhardt's Handbuch f. Kinderkr., B. 2.

⁷ Transactions American Medical Association, 1881.

² Zeitschr. f. klin. Med., 1885, 10, 1.

⁴ Jahrb. f. Kinderheilk., 5 Jahrg., 4 H.

⁶ Lancet, 1880.

symptoms are usually limited to slight malaise, with headache, joint pains, giddiness, faintness, anorexia, and rarely nausea and vomiting; very exceptionally convulsions are noted (Smith, Lindwurm, Edwards). Shivering and an initial chill¹ may begin the attack. Smarting of the eyes and slight photophobia may occur, but beyond conjunctival injection, catarrhal symptoms are generally absent; sneezing, snuffling, cough, and hoarseness, and even croupy attacks (Balfour) may develop. The tongue is slightly coated with a dull, whitish fur. Often at this stage mild pharyngeal distress is experienced and the fauces show a diffused or a maculated hyperæmia.

A common symptom of this stage is the adenopathy characteristic of the stage of eruption, involving the occipital, posterior, and anterior auricular, submaxillary, cervical, and often other glands. These become enlarged to the size of coffee-grains or larger, are tender, and may occasion swelling and stiffness of the neck. This may be the most striking symptom of this stage and may attract attention several days before the eruption appears. It is, however, not constant. In many cases fever is absent. Very often it is present to a slight extent and may subside before the beginning of the eruption (Emminghaus). In 20.1 per cent. of v. Nyman's cases it lasted only 24 hours, but was absent altogether throughout the attack in 48.73 per cent. All of Emminghaus's cases began with fever, rarely exceeding 38.5° C. (101.3° F.), and rarely reaching this point. When prodromes were prolonged into the second day, this writer noted a morning remission passing into an exacerbation as the eruption appeared. Edwards observed epistaxis among the prodromes, three times. This author thought that the prodromal symptoms increased in severity until the eruption appeared; but it is to be noted that the intensity of these symptoms bears no fixed relation to the severity of the subsequent course of the disease. Characteristic of rōtheln, however, is the short duration or entire absence of febrile symptoms previous to the appearance of the eruption.²

STAGE OF ERUPTION.—Very often the patient is unconscious of his attack until accident reveals the eruption. In the great majority of cases upon awakening in the morning he feels unwell, and discovers the eruption upon examining his body at once, or after a brief prodromal period. It usually appears first upon the forehead and temples, rapidly extending over the face and neck, in a few hours spreads to the trunk, and thence to the upper and lower limbs. It becomes visible as pale pinkish-red macules of minute size. A faintly reddened condition of the parts first invaded may precede the exanthem. Emminghaus noted a ring of efflorescence around the neck sending prolongations between the scapulæ and over the breast between the nipples. Exceptionally the eruption

¹ Initial chill was observed in 15.46 per cent. of v. Nyman's cases.

² Duckworth, *Lancet*, 1874, 1, p. 360.

may bloom out at once over the whole surface, but almost always it attains its maximum upon different parts unequally and in the order of evolution. Upon the trunk and extremities the lesions may be at their height, while upon the head and neck they may have almost disappeared, or the reverse may occur when, as rarely happens,¹ the latter parts are last invaded. It is so fugaceous, that by this maximum intensity in different parts it affords a striking contrast with what occurs in measles usually. This evanescence has probably served to foster Heim's erroneous theory of "a local rötheln."

The eruption of rötheln is by no means uniform, and a recognition of this fact is essential to a correct appreciation of the affection. Various eruptive types have been described, for convenience, but almost invariably a more or less irregular development is observed. It is in the mildest and afebrile cases that the eruption becomes most characteristic. It then acquires a punctate appearance and a pale rose color. At first the spots do not contrast markedly with the unaffected portions of the skin, but soon they acquire a brighter color and more definiteness. They have a rounded appearance, and are not grouped into crescentic shapes, as in measles. They vary from pin-head to hemp-seed size and larger, and have been compared by Paterson, of Leith, and Heim to the effect obtained by touching white blotting-paper with a pen charged with red ink. Their color, however, is not so brilliant and their outline by no means so regularly circular as the comparison would indicate.

In mild cases they may remain isolated almost throughout. Here and there they become confluent, and in more pronounced cases confluence is frequently observed. There is always some, and sometimes marked elevation of the lesions, but the papules remain soft. By a strong and oblique light the irregular elevations may be plainly seen. The lesions are sometimes larger. They are then apt to lose the circular outline, and may be twice the size of the smaller lesions. Each spot is surrounded by an areola, and is more vividly colored toward the centre in consequence. The eruption is most abundant on the face, chest, nates, and often on the arms, forearms, and flexor surface of the thighs. The color is most vivid above, but is often intensified by the warmth of the clothing. The patches often increase in area and coalesce, and may then simulate the rash of scarlatina. The original lesions may be distinguished by pressing the surface firmly with the finger, when they will be seen to become less anæmic under the pressure than the surrounding parts (Heim). Large plaques of continuous eruption differ from the scarlatinal efflorescence in being paler, and in never prevailing to such a degree that the predominating maculo-papular character is not shown in parts less extensively invaded. They may often involve the flexor

¹ Tonge-Smith.

(on the second day). According to Tonge-Smith, the temperature rarely exceeds 100° F. Edwards observed a common rise of from 1° F. to 3° F.; rarely it reached 103° – 104° F. Hemming rarely saw it exceed 101° F. While Roth considers absence of fever the characteristic condition, he has seen a temperature of 38.3° C. (100.9° F.). In only 2 of v. Nymann's 119 cases was 39.5° C. (103.1° F.) indicated. Only one-half of Klaatsch's cases had fever, and they only during one day (38° C., seldom 39° C. (100.4° – 102.2° F.) in the axilla). All of Emminghaus's cases had fever, seldom exceeding 1.5° C. (2.7° F.) rise, and rarely attaining it. In Kassowitz's cases an elevation of 1.5° – 1.8° C. (2.7° – 3.2° F.) in the axilla was constantly observed. In all cases efflorescence was complete on the second or third day. Rott observed no fever except in complicated cases. On the other hand, high temperature was noted by E. Long Fox (103° F.), Robinson (103° – 104° F.), Edwards, and others. It may be stated, as a rule, that the temperature in r  theln does not exceed 100° F. Slight exacerbations of fractions of a degree may be recorded as the parts are successively invaded by the eruption, but, upon the whole, rapid defervescence follows, the normal being reached, except after complications, before the completion of the eruption.

Conjunctival hyper  mia, usually developed in the prodromal stage, when such is present, persists with a sense of smarting during the attack. Lachrymation and photophobia are uncommon. Nasal, buccal, laryngeal, tracheal, and bronchial catarrh are absent, as a rule, in milder cases. At other times there is mild catarrh of these surfaces (Thomas). Lewis Smith noticed catarrh of the nasal, buccal, and faucial, but not of the laryngeal, tracheal, or bronchial mucous membrane. Park observed bronchial irritation in about ten per cent. of his cases with conjunctival suffusion, and had he not known that the same children had had measles, he would have been tempted to diagnosticate these cases as such. It may be concluded that although absence of catarrhal inflammation cannot be regarded as typical of r  theln, this complication is vastly less pronounced than with measles, and affords a striking contrast between these affections. The faucial mucous membrane, however, is almost constantly implicated in r  theln. Nearly all writers have observed this. Schwarz¹ thought he had established a diagnostic point between r  theln and measles in indicating in the latter affection upon the faucial mucous membrane, pinhead to hempseed and lentil-sized spots, discrete and reddish, but at times confluent and irregular, which are not seldom observed before the eruption. This undoubtedly holds for measles, but it is valueless for diagnosis, for the throat eruption of r  theln often exactly resembles that of measles. It is true, the usual appearance of the fauces in r  theln is of a diffuse redness, like that or

¹ Wiener med. Presse, 1868, ix. 302.

mild pharyngeal catarrh, or of mild scarlatina. This is unaccompanied by much swelling or difficulty of deglutition; there may, indeed, be no subjective faucial symptoms. But quite as often, this eruption is like that of measles,¹ or the throat may have a streaked appearance. The redness extends to the palate, throat, tonsils, and larynx, but hardly ever exceeds simple hyperæmia. Lewis Smith, however, has seen mild diphtheritic inflammation. While the faucial efflorescence cannot be considered essentially different from that of measles, it is sufficiently marked to constitute a characteristic symptom of r theln. Usually very transitory, it may persist after the subsidence of the eruption. It is more often diffuse than macular. Faucial redness was absent in only 11 of v. Nymann's cases. It disappears almost invariably by the fourth day of the disease.²

The digestive tract remains about as in the stage of prodromes. The tongue is rather coated, often showing a few red papill e toward the tip. In severe cases it may become dry and brownish. The appetite and digestion are frequently hardly impaired. When fever is at all marked, the digestive tract may suffer in proportion to the degree of derangement incident to the febrile condition. A very remarkable adenopathy gives r theln one of its most distinctive symptoms. This often precedes the eruption; more often it appears as this develops, and consists in a painful but never suppurative enlargement of the cervical, submaxillary, anterior and posterior auricular and occipital glands. The enlargement of these glands, with the eruption, often gives the patient a swollen, bloated appearance, and occasions troublesome "stiffness of the neck." Occasionally, the axillary, epitrochlear, inguinal, and popliteal glands are also enlarged (Tonge-Smith, Klaatsch). Trastour attributes to Bloch, of Denmark, the first description of this adenopathy. Klaatsch declares it so constant, that, in the dark, with the knowledge that an acute exanthem was present, the diagnosis of r theln can be made from it alone. Hardaway has never found it absent. It appears to vary, however, in the constancy of its occurrence in different epidemics. Park saw it in about fifty per cent. of his cases; Kassowitz, in about thirty-three per cent.; Emminghaus noted its frequent occurrence. Thomas believes it to be frequent but by no means constant. V. Nymann, however, did not observe it in his cases. Its usual presence is almost universally admitted. It must not be forgotten, however, that similar adenopathies are sometimes seen in measles. Its extent is not at all proportionate to the character and intensity of concomitant symptoms. Not rarely it is the first and only symptom to attract the patient's attention. It may not be amiss to suggest here that some of the peculiar,

¹ L ri, *Jahrb. f. Kinderheilk.*, 1882-83, N. F. xix.

² Tonge-Smith observed secondary sore throat on the fourth or fifth day.

acute, and transitory multiple glandular enlargements about the head and neck, without eruption but with mild fever and tenderness, that sometimes prevail extensively, the etiological relations of which have eluded identification, *may* depend upon r  theln. The glands speedily lose their sensitiveness and diminish in size.

Kingsley, Harrison, Duckworth, and Edwards have reported albuminuria as occurring during the attack. The latter writer noticed it in thirty per cent. of his cases. In nine it was pronounced and accompanied by dropsy. Such observations are altogether exceptional and were probably due to local influences. Emminghaus observed slight albuminuria in one case. In two of five cases Duckworth observed transitory albuminuria. Most observers have never seen it complicate r  theln.

In many cases the eruption fades and leaves no trace. It is a peculiar feature of r  theln that, probably in the greater number of cases, desquamation fails to occur. This is not to be ascribed to any inherent property of the affection, but is due to the trivial degree of hyper  mia usually experienced. After more intense efflorescence, desquamation undoubtedly occurs, though so scantily that careful observation is often required to detect it. Steiner asserts, indeed, that there is no desquamation; Oesterreich, that it is almost absent; Squire, that there is almost none; Roth, that it is exceedingly uncommon; Robinson, that it is slight, and is imperceptible in mild cases; v. Nymann, that there is none; Emminghaus, that there is no notable desquamation, but that in most cases a slight furfuraceous scaling exists. Wagner, de Man, Balfour, Thierfelder, Mettenheimer, Lindwurm, Veale, and Arnold hold similar views. Henning noted more or less branny desquamation lasting five to twelve or fifteen days. Trastour describes it as furfuraceous, as also does Edwards. Hardaway states that a fine desquamation follows, but by no means invariably. It becomes evident that the usual absence of desquamation does not partake of the nature of a peculiar feature of the disease. When present, it is most commonly observed in depressed areas of the surface, as behind the clavicles or parts but little exposed to friction. Nearly all patients remain up and about the house during the attack and convalesce at once. The persistence of fever after the fourth day, or its recrudescence, should arouse apprehensions of complications.

COMPLICATIONS AND SEQUEL   are not unknown. The possible occurrence of nephritic trouble has already been noticed. The most common complications are exaggerations of the catarrhal disorders, bronchitis, pneumonia, gastro-intestinal inflammation. Numerous other complications have been recorded, but may generally be considered rather as accidents than as having specific dependence upon r  theln. Klaatsch quotes Kronenberg as reporting four deaths from bronchitis, pneumonia, and cerebral congestion after r  theln. Rott observed that mumps frequently

followed the exanthem in from three to five days. Edwards observed enteritis and thrush in his cases. Slight œdema (face and legs) and even general dropsy have been known to follow. Hardaway has seen otorrhœa and ciliary blepharitis. Nasal and buccal catarrh may constitute sequelæ. Very rarely, relapses of rœtheln are observed. They occur immediately or after several days, not later than a fortnight. (Emminghaus.)

PATHOLOGICAL ANATOMY.—The usually trivial character of the disease has not tended to awaken especial interest in its pathology or to afford opportunities to study its lesions. Thomas states, in a general way, that the eruption is due “to capillary hyperæmia of the papillary body and of the uppermost layers of the corium; this can give rise to slight inflammation and exudation between the uppermost stratum of the corium and the epidermis, but it only occurs exceptionally in a few cases and then only on single parts of the body, and involving only a minority of the spots.”¹ Nothing is known of the specific principle of rœtheln.

PROGNOSIS.—This is almost invariably favorable: Tonge-Smith reported no deaths in 145 cases; Park, none in 100 cases. Thomas says the prognosis is “thoroughly favorable.” V. Nymann, Steiner, Oesterreich, Emminghaus, Hardaway, Robinson, and, indeed, nearly all writers agree that it is the mildest of the exanthemata.

DIAGNOSIS.—The differential diagnosis of rœtheln is not difficult except as regards measles. Here, however, it is most obscure, and can only be made with satisfaction after consideration of all concomitant circumstances. Speaking generally, broad rules may be established and relied upon as pretty constantly correct. When, however, the diagnosis has to be made for the individual and isolated case, it must be admitted that we have no positive and characteristic signs for rœtheln; but the typical course of the affection markedly differs from that of measles, as is shown in the following table:

RÖTHELN.	MEASLES.
	<i>Contagiousness.</i>
Feebly contagious.	Violently contagious.
	<i>Incubative Stage.</i>
Usually from fourteen to twenty-one days. Often, however, less, but hardly ever less than one week. Rarely longer than twenty-one days.	Usually from nine to ten days. It may be only seven days or as much as eleven or twelve days. Very rarely less or more than these extremes.
	<i>Prodromal Stage.</i>
Very often none. Usually from one-half to two days. May be prolonged in rare cases to three, four, or even five days.	The eruption usually appears on the fourth day, sometimes earlier, rarely later.

¹ Ziemssen's Cyclopædia, vol. ii. p. 137.

RÖTHELN.

Frequently absent or limited to slight conjunctival hyperæmia. Nasal, faucial, and bronchial irritation rarely pronounced.

Catarrh.

Almost invariably present, affecting conjunctiva and respiratory passages. May be slight, but usually much more severe in mild cases of measles than in severe cases of rötheln.

Lymphatic System.

Painful enlargement of occipital, auricular, cervical, submaxillary, and occasionally of other glands; quite constant during eruptive and frequent during prodromal stage.

Painful enlargement of these glands decidedly uncommon.

Circulatory System.

Temperature very often normal throughout. Rarely exceeds 100° F. (37.8° C.). High temperatures only exceptionally observed. Maximum fever corresponds to development of eruption during first two days and does not necessarily correspond to maximum eruption. The fever rarely endures beyond the third day.

Fever always present, often intense. Maximum fever corresponds with maximum eruption on the sixth day. Defervescence rarely complete before seventh or eighth day.

Eruption.

Appears on the first, second, or third day, rarely later. Often disappears from parts first invaded before other parts are attacked. It is pale rose-red in color, and only rarely assumes a dusky red. It is usually discrete, sometimes diffuse. In the former case the lesions are papulo-macular and generally circular, and do not tend to form crescentic groups. In the latter cases, they often coalesce by fusion of their borders and form pale red continuous surfaces. These are not, however, universal and are always associated with the discrete rose-colored spots, which are not uniform in size and not always circular, but may be angular and measles-like. The eruption rarely persists beyond the third day and is often completed in forty-eight hours, but may last longer.

The eruption almost always appears on the fourth day, sometimes earlier, sometimes later. The lesions remain in full efflorescence until the maximum is attained, usually during the sixth day, when they begin to fade with the beginning of defervescence. They are papular and tend to form crescentic groups, at least on the face, neck, and upper portions of the trunk. They are mostly of a dark raspberry color and are very irregular in outline. They may coalesce into patches of dusky redness. Rarely the eruption may be pale in color or more circular and discrete.

Faucial Irritation.

Sore throat is present in nearly all cases, but hardly ever occasions difficulty in deglutition. A punctate, or papular, or diffused eruption appears upon the faucial mucous membrane. This may precede the cutaneous eruption.

Sore throat is uncommon, yet from eighteen to twenty-four hours before the cutaneous eruption appears, there may be seen small, hempseed-sized papules and macules scattered over the faucial mucous membrane.

RÖTHELN.

MEASLES.

Complications.

Very unusual; when present, generally involve the respiratory tract.

Very common, generally involving the respiratory tract.

Desquamation.

But rarely observed and then as almost imperceptible branny scales.

Branny desquamation constant and lasting several days.

Careful consideration of the two diseases shows that while the general points of difference are decided, they will often fail to apply in individual cases. There is no feature of either affection that may not be sometimes observed in the other, whether it belong to the incubative, præruptive, eruptive, or desquamative stages. This cannot be too much insisted upon, and to disregard it is to expose one's self to almost certain error. The incubative stage of rōtheln may be brief, that of measles protracted; the præruptive stage of the one may be lengthened, that of the other shortened; the catarrh of measles may be insignificant, that of rōtheln pronounced; fever may be slight or intense in each disease; in both, the eruption may appear early or late and may run a brief or prolonged course. Departures from typical eruption may be observed in either, and the features supposed to be peculiar to one may, in reality, not seldom appear in the other. The faucial eruptions are not essentially different. Even the adenopathy supposed to be so characteristic of rōtheln may be encountered in measles. Finally, desquamation may be absent in measles, it often occurs in rōtheln. Klaatsch insists upon, as constant symptoms, conjunctival injection, redness of the fauces, and swelling of the lymph glands; but these symptoms offer no distinguishing characteristics. Are there, then, no peculiar signs upon which a diagnosis may be based with certainty? Considered separately, we must confess that there are none. Taken together, the symptom-complex would enable one to speak with perfect confidence only in presence of the following conditions, viz.: (1) The prevalence of an epidemic in which the history and symptomatology of the disease correspond to a type similar to that laid down in these pages, and (2) the infection of persons exposed to it quite irrespective of previous attacks of measles.

During an epidemic of measles, it must always be unwise to diagnose unhesitatingly, as rōtheln, a single case in which the course and history of this affection may be observed; for, without doubt, such attacks often follow exposure to measles and communicate measles to others. On the other hand, in an epidemic in which the same course and symptoms are generally observed, and in which all exposed persons are attacked, irrespective of previous attacks of measles, the diagnosis of rōtheln may be made with certainty. Between prevailing measles and prevailing rōtheln there are differences that usually permit the pathological relationships of given cases to be determined without difficulty.

The symptoms typical of r  theln may also usually be recognized in those who have already experienced an attack of measles, even when occurring sporadically; but of isolated cases, occurring in those who have already had neither measles nor r  theln, one should not venture to speak of more than probability, though in many cases this may be done with some degree of confidence. If one makes the test for r  theln, in a person suffering from a measles-like attack, the fact that he has already had measles, as has been done formerly, and is again being done by some writers, he introduces an unscientific element into the study of the disease that *must* entail disaster. This conclusion appears almost inevitable when we consider that undoubted reinfections with measles are sufficiently known; for although older writers denied that such reinfections occur (Willan never saw them), later observers have shown that they are frequently encountered and that an individual has been known to undergo even a third attack.

Tryanski¹ noted in 200 cases of measles, 14 recurrences with intervals of from six months to seven years, the average being three years. Kassowitz reported reinfections in which the attacks closely resembled r  theln, but could be traced to exposure to measles, and from which measles was communicated to others. Similar experiences have also been reported by many other writers, among whom may be mentioned Hennig² and Schwarz³ (who noted recurrence of measles in eight of sixteen cases, all with the exception of one case having both attacks under his own observation). In a recent epidemic of measles at the "Home of the Friendless," in Baltimore, under the writer's observation, of thirty-one children attacked with measles five had a return of symptoms within six weeks; in each case the second attack was exceedingly mild, presenting features that might perfectly well have justified a diagnosis of r  theln, with this difference, however: of all the children exposed only these five developed the second eruption, a result that would not have been observed had r  theln been the cause of it. These considerations, however, bear only upon the relations of sporadic cases of r  theln. Recurrent measles is uncommon, and is quite unknown as of epidemic occurrence.

There occur, it is true, in epidemics and sporadically, cases resembling measles and yet unlike it, attacking alike those who have had and those who have not had measles, yet in important particulars differing from all of the acute exanthemata as we now understand them.⁴ Such cases,

¹ Dorpat med. Zeitschr., 1873, iii.

² Arch. f. Kinderh., 1874-76, 8.

³ Wien. med. Presse, 1876, 43-45.

⁴ Cheadle, for example, has described an epidemic affecting many who had already had measles, the symptoms of which were remarkable for their intensity and presented peculiarities unlike those described by nearly all writers upon r  theln. If the patients had not already had measles, one would never have called the affection r  theln. It would even seem more probable that Cheadle treated measles in those who had already had r  theln.

it is said, cannot belong to measles, since those who have already had this affection are not protected. They are of uncommon occurrence, and eventually will probably prove to be bastard forms of measles or scarlatina, or possibly some as yet not understood disorder, or results of the concurrent activity of more than one specific affection; at all events, we are not justified in recognizing them as r  theln until clinical observation has demonstrated them to be such.

Scarlatina differs from r  theln in its shorter incubation, its violently febrile onset, the intensity of the throat symptoms, the peculiar condition of the tongue, the character and longer duration of the eruption and fever, the copious desquamation, and the peculiar complications and sequel  . Mild cases of scarlatina may be mistaken for r  theln, but the diffused form of eruption in this affection can offer only difficulties, and even here the spread-out red patches always pass at their margins into the easily recognized pale maculo-papules that clear away doubt. Non-specific erythematous affections are so circumscribed, or are so evidently traceable to their exciting cause, that doubt can hardly arise unless the question of idiopathic roseola, epidemic roseola, etc., be raised. The difference here will be rather of words than of meaning, since there is little doubt that this affection and r  theln are identical. Occasionally maculo-papular medicinal rashes have been mistaken for r  theln, and the writer has known the adenopathy and eruption to be looked upon as syphilitic roseola and adenopathy at first.

TREATMENT.—Very little treatment is ever required; indeed, but few find it necessary to keep in bed or even within doors during the attack. Treatment may be called for when complications arise. Such accidents are rare, but when present must be treated according to their necessities and without special reference to the exanthem. As the contagious properties of r  theln are not pronounced, and as they are soon exhausted, isolation, should it be desirable, need not be as protracted as with scarlatina, smallpox, measles, etc.

CONCLUSIONS.—1. R  theln is a specific, contagious, eruptive disorder.

2. While it possesses pretty well defined characteristics, which, taken together, justify a reasonable degree of certainty in its diagnosis, it has no symptom that may not be and is not often assumed by measles.

3. A sporadic case, occurring in one who has never had measles and who affords no history of exposure to r  theln, may be diagnosticated with a fair degree of confidence, but not with absolute certainty.

4. The unqualified diagnosis of r  theln should only be made during an epidemic in which all persons exposed, irrespective of former attacks of measles, are liable to be affected and in whom the symptoms follow a pretty uniform type. In the absence of a pronounced epidemic influence, a series of cases occurring in a household, a school, or an asylum,

showing typical symptoms, may be diagnosticated as r  theln with a fair degree of confidence.

5. In sporadic cases, where neither measles nor r  theln has been experienced, a diagnosis of probable measles or r  theln must be made, accordingly as the symptoms and course resemble the type of one or the other affection.

A final word of explanation and defence of the title under which this paper appears, is due. Most unfortunately the term *rubeola*, which in Germany, since the time of Hildebrandt, is universally adopted as the classical name for our affection, is to English-speaking races inseparably connected with the conception of measles. This has driven English-speaking writers to have recourse to the German word r  theln. To one unacquainted with the German language, this title is unmeaning, is not euphonious, and is a source of embarrassment. First employed by Werlhof, in 1759, it is now firmly established and definitely understood in Germany. Unable unqualifiedly to adopt "rubeola" and "r  theln," the medical public has hit upon "German measles" as designating the malady in question, and under this name it is becoming generally recognized. Yet this is a most unsatisfactory and unscientific evasion of the real issue, and implies a relationship which is not admitted. I would suggest, therefore, that the title first proposed, I believe by Veale, and afterward by Squire, and adopted in Quain's *Dictionary*, *rubella*, be accepted as the prime name of the affection; and as "German measles" is manifestly a most objectionable designation, I also suggest that the affection be popularly known as "epidemic roseola," a term that has the advantage of age, and that was undoubtedly originally applied to it, though under a different conception of its nature.

19 CATHEDRAL STREET.

ON SOME FORMS OF ALBUMINURIA NOT DANGEROUS TO LIFE.

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THE gravity of albuminuria as a symptom has been differently estimated at different times. It is not much more than a hundred years since Cotugno discovered the fact of its occurrence, and not much more than fifty years since Dr. Bright made out the relationship between it and the diseases of the kidneys which came to bear his name. For a long time after his discovery the utmost dread of the occurrence of the symptom existed in the mind both of the profession and the public, most people regarding its existence as unfailing evidence of grave organic

disease. But gradually it has come in recent years to be known that albumen often appears in the urine, even in considerable quantity and very persistently, in persons free from important organic malady. Indeed, it may be maintained that some patients with persistent albuminuria are yet eligible for life insurance at little, if at all, above ordinary rates.

It is important to know the characteristic features of these non-dangerous albuminurias. But they are so numerous, and require such careful discussion, that I could not do them justice in a single paper. I must, therefore, meanwhile set aside several varieties. Thus, I shall not take up the group which may be called accidental albuminurias, in which the albumen is accounted for by the admixture with blood, pus, spermatic or prostatic fluid. Neither shall I discuss the albuminuria associated with infective processes and high temperature, which is often seen in pneumonia, erysipelas, diphtheria, and the specific fevers. Nor shall I consider the albuminuria attending upon various nervous disorders such as exophthalmic goitre, epilepsy, and apoplexy, nor such forms as that which Claude Bernard produced experimentally by puncturing a point in the floor of the fourth ventricle. Nor shall I dwell upon the albuminuria which Dr. George Johnson has found to be so often induced by the health-giving exercise of cold sea-bathing. Nor, lastly, shall I speak of the form due to passive congestion from cardiac disease or vascular obstruction.

Such groups as these having been put aside, at least four categories can be defined, which, although they run into one another and mutually overlap, perhaps varying in the same individual from time to time, may yet with advantage be distinguished. These are, 1st, paroxysmal albuminuria; 2d, dietetic albuminuria; 3d, albuminuria from muscular exertion; and, 4th, simple persistent albuminuria.

I do not know whether this classification will ultimately turn out the most satisfactory, but I shall certainly be able to illustrate each of these varieties with cases markedly characteristic. In a few words I may explain the substance of what I deem the most important contributions to the subject in recent literature. Many years ago Sir Robert Christison pointed out that the use of certain articles of diet and luxury sometimes induces temporary albuminuria. Jaccoud¹ formulated the statement that there are cases of persistent albuminuria in which the patient is substantially in good health, and in which there is no kidney disease. He therefore distinguished between persistent albuminuria and albuminuria from Bright's disease. Dr. Moxon² gave definiteness to our ideas by his paper, published in 1878, on chronic intermittent albuminuria. He divided cases of this kind into two classes: 1st, the albuminuria of

¹ *Nouv. Dict. de Méd.*, i., Paris, 1864. Quoted in *British and Foreign Medico-Chirurgical Review*, April, 1868, p. 325, etc.

² *Guy's Hospital Reports*, 1878, vol. xxiii., 3d series.

adolescents, in which the symptom continues during a long period in a desultory and irregular way, so that in some it is rather occasional than intermittent; 2d, remittent albuminuria, in which the albuminuria is in greater quantity and occurs more constantly from day to day, especially in the urine passed after breakfast, but is usually wanting in that passed in the early morning. He further divided these remittent cases into two groups, in one of which there is renal disease, in the other none. With regard to the albuminuria of adolescence, Dr. Moxon pointed out that it is a state of health to which young men are subject, which from its frequency deserves a special name. The patient is out of condition, listless, and languid, sleeps too much, and yet rises unrefreshed, is anæmic, and gray and sunken about the eyes. It is simply a state of debility without any organic disease. The urine is found to be at times albuminous—most often after breakfast, while at other times it is quite free from albumen. He had met with nineteen cases of it, and of the seven cases he records two pairs of them were brothers, while another brother in one of the families affected was under his care with a different urinary abnormality—the persistent presence of a large excess of urea. This paper, as I have said, defined our knowledge, but that the existence of non-dangerous albuminuria was an idea familiar to acute physicians may be shown by the fact that Sir William Gull had told Dr. Moxon that in his experience albuminuria is almost as common in young and growing men and boys as spermatorrhœa. Dr. T. Morley Rooke¹ drew attention to the remarkable effect of rest in the recumbent posture in removing or keeping in abeyance the albuminuria of adolescence, and Dr. Burney Yeo² dwelt upon the importance of muscular exercise as a cause, and of rest in bed and the effect of food and wine as means of lessening the albuminuria.

Dr. Clement Dukes,³ discussing the albuminuria of adolescence on the basis of his experience as physician to Rugby, pointed out that it is extremely common and presents a great variety of features, both in its causation and special characters. Sometimes a sudden change in temperature, sometimes an error in diet, sometimes excessive exertion, sometimes mental emotion induces it. He showed that sometimes the diet has no effect, at others the most marked, so that a patient who has no albuminuria when taking milk may get it when he adds a little bread to his diet, and one who, going about, requires to limit his food in the strictest way, can eat and drink freely if he remains in bed. It may be persistent for a very long time or it may disappear and reappear; it may be absent at one time of the day and present at another.

I shall not detail anything of the important contributions of Mahomed,⁴

¹ British Medical Journal, 1878, vol. ii. p. 596.

² Ibid., Nov. 30, 1878, p. 794.

³ Ibid., 1878, vol. ii. p. 627.

⁴ Lancet, Jan. 18, 1879, p. 77.

Fürbringer,¹ Runeberg, Saundby,² Leube,³ George Johnson,⁴ Quain⁵ and Semmola,⁶ and Stanley Rendall,⁷ but pass at once to a communication by Dr. Pavy,⁸ made at the British Medical Association meeting in 1855, in which he suggests the name cyclic albuminuria and gives interesting details of a number of cases. He describes the diurnal appearance and disappearance of the albumen very much as Dr. Moxon did. There may, he says, be considerable variation in the amount of albumen on different days. It may go on for weeks, months, or years, without impairment of health. There may be sharp, unduly forcible cardiac impulse, but the pulse is soft, not hard and sustained. There is nothing, he says, to show that it is an early stage of Bright's disease or that it leads to any serious disorder. The urine is otherwise normal as a rule, with no casts, but occasionally sugar has been detected, while oxalate of lime crystals are frequently present. The age of patients observed varied from nine to forty-nine. Three cases were in children aged nine, eleven, and thirteen respectively, two boys and one girl. Dr. Pavy offers no theory, but compares the condition with some analogous phenomena of a diurnal character. Thus in the phosphatic diathesis the urine may be normal in the early morning, whilst for a few hours after breakfast it is turbid from the presence of phosphates, becoming clear again in the afternoon and remaining so till after breakfast next day. There is also a diurnal variation in the temperature of the body. Thus a physiological cyclic change exists of which other illustrations could be adduced. This paper has given fresh impetus to the study of these cases.

Dr. Maguire,⁹ in an able and interesting communication, has suggested that we may recognize three classes of functional or cyclic albuminuria: 1st, those accompanied by general languor, low tension pulse, and no deposit of uric acid in the urine; 2d, those with robust health, pulse of high tension, frequently some dyspepsia, and a copious deposit of uric acid; 3d, rare cases in which some abnormal albumen is present in the urine.

Having thus given an idea of some of the chief recent observations on this subject, I proceed to describe and illustrate our four varieties.

I. Paroxysmal Albuminuria. I shall perhaps best convey an idea of the features of this form of albuminuria if I describe a typical case which I studied in the wards of the Old Infirmary. A young woman

¹ London Medical Record, 1880, pp. 449 and 450.

² British Medical Journal, May 10, 1879, pp. 699 and 700, and June 5, 1880, pp. 841-843.

³ Lancet, 1878, vol. i. p. 501; 1881, vol. i. p. 468; and Medical Times and Gazette, Nov. 9, 1878, p. 546.

⁴ British Medical Journal, Dec. 13, 1879, pp. 928-930.

⁵ Lancet, Jan. 18, 1879, p. 86.

⁶ Ibid., Oct. 18, 1879, p. 583.

⁷ Étude sur l'Albuminurie alimentaire, Thèse pour le Doctorat en Médecin, Paris, 1883.

On Cyclic Albuminuria, British Medical Journal, Oct. 23, 1885, p. 789.

⁹ Lancet, June 5, 1886, p. 1062, and June 12, 1886, p. 1106.

was admitted on account of acute illness. She had general *malaise*, some degree of fever, and gastric catarrh, but on examination, nothing further could be discovered amiss excepting that the urine was rather scanty, dark in color, and was loaded with albumen. The microscope showed tube casts in great number and of several varieties—epithelial, granular, and hyaline. There were also some crystals of oxalate of lime. There was a degree of puffiness of the face, but no dropsy, and, notwithstanding the urgency of the renal symptoms, I ventured to express the opinion that the illness would prove transient and unimportant. My reasons for so doing were the suddenness of development of the renal symptoms and the discrepancy between them and the general condition of the patient, and the opinion was further confirmed when it transpired that similar attacks had previously occurred and had speedily passed off. The next day the patient was much better; the albumen was disappearing, the tube casts were no longer so numerous, and before many hours had elapsed she was quite well.

This form of albuminuria stands in very interesting relationship to what is called paroxysmal hæmatinuria or hæmoglobinuria, a disease which is ascribed by many to a morbid action of the liver. The patient in the intervals between the paroxysms may appear to be in good health. The attack begins with a slight feeling of chilliness, or a rigor attended by some uneasiness in the region of the liver and in the small of the back. The urine is of a dark color, due to the presence of blood pigment. As a rule, the color is due simply to hæmoglobin, but sometimes blood corpuscles may be detected in the freshly passed urine. They, however, even when present soon break down, and the blood pigment is liberated. There is, therefore, in this disease a hæmolytic process, a destruction of red blood-corpuscles probably due to some temporary derangement of the liver, and the liberated pigment is discharged by the kidneys. A single micturition may discharge all the hæmoglobin which has been set free, or it may appear during two or three micturitions. Now I think I may more clearly bring out the close relationship which exists between this disease and that which I have called paroxysmal albuminuria, by relating a case described by Rosenbach.¹

A little boy, seven years old, after a severe fall from a wagon, became subject to attacks of periodical hæmoglobinuria. The attacks occurred pretty frequently, and exhibited the features common in the disease. The most interesting point for our present purpose is that at the beginning of each attack, before the hæmoglobin appeared, the urine became albuminous. This is by no means an exceptional circumstance; indeed, it will be found in many cases of hæmoglobinuria. It is probable that the

¹ Quoted in London Medical Record, 1880, p. 450.

process originates either in the nervous system, inducing a morbid action of the liver, or in a primary affection of that gland; and that it causes blood changes which irritate the kidneys, giving rise to a transient inflammatory action during the process of elimination of the waste products. Whether this view of the pathogenesis of the process be correct or not, the clinical relationship of hæmoglobinuria to the form of albuminuria we are now discussing is unmistakable. The relationship is rendered the more distinct by their etiology, for, like those of paroxysmal hæmoglobinuria, the attacks of paroxysmal albuminuria are apt to be brought on by cold and wet, sometimes by errors of diet and alcoholic intoxication.

The characteristic features of this group of cases are easily recognized. The sudden and copious occurrence of albumen in the urine with numerous casts, the process lasting only a short time and recurring at intervals with or without a perceptible exciting cause, will justify you in diagnosing the condition.

What view are we to take as to the explanation of the process? Is it to be referred to changes in the secreting structures, in the bloodvessels, or in the blood itself? Considering that we have so marked a discharge of casts and epithelial cells, it is obvious that we must admit changes in the secreting structures. Alterations in the blood pressure may exist, but only as a secondary element. Changes in the blood itself, although not demonstrated, are, in my opinion, extremely probable, and they most likely induce the alteration in the kidneys. Irritation of the kidneys from blood changes is a very common phenomenon. It must frequently have been noticed how, in cases of many varieties of jaundice, albumen, and tube casts appear in the urine, and this evidently as a result of irritation of the kidney by the products of the hepatic disorder. In cases of oxaluria a similar change, probably depending upon a corresponding cause, has been noticed. The analogy with the hæmoglobinuria process supplies another consideration in favor of the view. Thus is clearly seen the hypothetical explanation which at present commends itself to my judgment.

If this view be correct, it is obvious that our treatment in such cases should be directed, on the one hand, to the avoidance or diminution of renal irritation, and on the other, to the regulation of the hepatic function and of the chemical processes in the body. Happily, the attacks are usually of brief duration, and I have never known them prove permanently injurious. The chloride of ammonium is the remedy in which at present I put most confidence. It must, of course, be given with due regard to the avoidance of renal irritation.

II. *Dietetic Albuminuria* is a variety which has long been more or less distinctly recognized. Some people suffer from it whenever they indulge in certain articles of diet. In some cases one kind of food, in others

many require to be proscribed ; cheese, pastry, and eggs are among the more common offenders. My first experience of such cases was obtained when I was resident in the Infirmary. A member of the staff used sometimes to make his appearance with a pasty, puffy condition of eyelids, and he found that this was associated with albuminuria. His albuminuria proved to be dietetic. If he indulged in even a moderate amount of cheese or of pastry the symptom was pretty sure to arise. Such a passing and temporary albuminuria always and exclusively following upon error of diet is easily made out and avoided. On the other hand, there are some cases in which the albuminuria is little, if at all, determined by the kind of food, but the entrance of food of any sort into the stomach suffices to induce the symptom ; and there are many in which the food determines the occurrence of albumen, and in which, nevertheless, some other factor plays an important part in its production. In dietetic albuminuria we must, therefore, recognize at least these three factors as possible exciting causes : first, the use of certain kinds of food ; second, the entrance of food (of any kind) into the stomach ; and, third, one or both of these, in association with other influences, such as exercise or time of day. It will be readily gathered from the examples to be described, that each of these factors has very different amount of influence in different cases, the symptom being almost entirely due to one in some cases, to another in others.

I shall illustrate this variety by a negative and a positive instance. A gentleman consulted me some years ago on account of albuminuria. and when I was searching for the cause it transpired that his dietetic habits were such as might well have accounted for the symptom. He was accustomed to a luxurious table, and acknowledged a special partiality for cheese. I asked him which were his favorites. He named Stilton, Rochefort, and Gorgonzola. I inquired as to the quantity, and he indicated an amount three inches long, an inch and a quarter broad, by at least an inch thick. I expected that this would prove to be an important causal element in his case, and after various other experiments I directed him to take a good piece of one of his favorite cheeses, but found that no albuminuria existed. Indeed, I found that diet had little or no effect upon his urine. On testing it after dinner on one occasion I found that, although the meal had included a good allowance of *pâté de foie gras*, chicken croquets, roast pigeon, with spinach, gooseberry tart, and a pint of Marcobrunner, the urine was normal. On another occasion, when a Welsh rarebit constituted part of the meal, a like result appeared. I found also that a breakfast of fried sole, a cup of coffee with milk, and a pint of milk with bread did not produce albuminuria, and a sumptuous luncheon was alike inoperative. The only food which seemed to induce the albuminuria was new hot bread. Thus, it was clear that my first impression was wrong, and that the albuminuria

in this case was not of dietetic origin. I shall show further on what its cause really was.

I shall now refer to a case in which a positive effect was apparent. The patient, then a medical student, called upon me first in the autumn of 1881, complaining of headache and dyspepsia. The heart's action was not satisfactory, but gave no indications of structural change either in the organ itself or in the kidneys. There was distinct, although not copious, albuminuria, unattended by tube casts or other token of organic renal disease. I ordered him a mixture containing chloride of ammonium and tincture of perchloride of iron. In the course of a week the albumen had diminished to a faint trace, and by the end of a fortnight it had disappeared entirely. It did not recur until the following summer, when his vigor was reduced, owing to the work for the final examination and to anxiety in connection with the death of his father. It was then observed that, although not present in the morning urine, there was a distinct trace directly after food entered the stomach. The rapidity of its onset was very remarkable. As soon as food of any sort was taken albumen began to be discharged by the kidneys. Being by this time a well-educated medical man, he was much interested in this circumstance, and found by experiment that if after commencing a meal he passed a little water, it was sure to be albuminous, although that passed a few minutes before was not. But in this case the symptom was influenced by the season of the year and the time of the day. It occurred only in summer and, while easily induced in the morning or at midday, it never appeared during the evening or at night. It had its special periods, but even during them the ingestion of food was the determining element. The breakfast and the midday meal always produced it, but never was a trace discoverable in the evening, whatever food was taken. The nature of the diet had at all times very little effect. If he lived upon rich food the albuminuria became no worse. If he made Revalenta Arabica and such like substances, his diet, it appeared all the same. Even a milk diet seemed to produce no favorable effect, but he could not persevere in its use, as it did not suit him.

The results of exercise were carefully tested. They were found distinct, but much less marked than those of food. If he fasted of a morning, no amount of exertion induced the albuminuria. But if, when the albuminuria had been induced by eating, he took exercise, its quantity at once greatly increased. On the other hand, as with food, exertion failed to produce it during what I may call the non-albuminuric portion of the twenty-four hours.

There never were any tube casts, but oxalates were frequently present. The urine was occasionally high colored, never bloody, sometimes deposited urates, but never uric acid. He never had pain in the back or other local symptoms to draw his attention to the renal functions.

The albuminuria has recurred each summer till this year, but in 1885 it was very slight, and this year has passed as yet without its appearance. The last specimen of urine examined was natural in color, specific gravity while warm, 1.020, distinctly acid, and contained no albumen or sugar. The condition of the heart is the same as it was in 1881. The state of the vessels is also the same as before, with perhaps a little increased tension. The walls of the radials are distinctly thickened. When the albumen was present there was always, he says, some intermission of pulse, but this has continued during the last year although the albumen has been absent.

By way of treatment, various plans were tried. Arsenic failed entirely. Iron produced little benefit. Spinal douches of cold water falling from a height of eight feet did much good. But, on the whole, nothing proved so serviceable as the combination of iron with chloride of ammonium.

Summing up the facts ascertained in this case we find—

1. That albuminuria occurred only after ingestion of food.
2. That it occurred in summer and at certain periods of the day, viz., after breakfast and after the midday meal—never before breakfast or in the evening.
3. That its onset was sudden, setting in as soon as food reached the stomach.
4. That the nature of the diet appeared to have little or no effect.
5. That exercise had a decided effect, but only secondary to that of food.
6. That the albuminuria was worse after mental excitement.
7. That cold douches applied to the spine checked, while cold sitz and Turkish baths (without the cold douche) increased the albuminuria. If, however, he took either a Turkish or a cold sitz bath in the morning when he had no albuminuria, neither of them produced it.
8. That counter-irritation to the loins by mustard or croton oil did not at all diminish the albuminuria, but rather increased it.
9. That, as regards medicines, arsenic had no effect, and while iron proved slightly beneficial, chloride of ammonium was much more efficient.

The first question which arose as to diagnosis in this case was whether Bright's disease existed or not. The state of the vessels, in respect both of their walls and tension, might have corresponded to this, and the heart's action was such as one sees occasionally in renal cases. But there had never been a trace of dropsy, there were no tube casts, the specific gravity was good, and the albuminuria came and went. Therefore, there was manifestly no inflammation of the tubules. The quantity of the urine, the specific gravity, and the absence of consequent complications, such as the retinal changes, excluded a diagnosis of cirrhosis,

while there was no polyuria, or any causal or concomitant complications fitted to suggest waxy disease. It was also certain that the albuminuria was not an accidental result of disease of the urinary tract. I therefore concluded that it belonged to the category of unimportant albuminurias and gave from the first a correspondingly favorable prognosis. It was only later that all the facts which I have mentioned became known to me, and now, surveying them, it is clear that we have to do with a form of albuminuria mainly dietetic, although influenced in an important measure by season and time of day, and in a minor degree by exercise.

Deferring what I have to say regarding the causation of dietetic albuminuria, I must express the wish that I could throw definite light upon the curious annual and daily cycle observed in the case—not a cycle of albuminuria, but a cycle of capacity for dietetic albuminuria. With our present knowledge, speculation on this subject is, however, not profitable.

This patient's constitution is peculiar, combining a marked nervous excitability with a tendency to hepatic derangement. He is liable to mental depression—often suffers from what he calls an ill-defined dread. His complexion is sallow, especially during what he terms his bilious attacks. These are attended by general malaise, headache, catarrh of stomach, irregularity of bowels, and functional disturbance of the liver. He is greatly impressed with the value of chloride of ammonium in the treatment, not only of his renal, but also of his nervous symptoms and his digestive disorders.

In order, then, to clear up the diagnosis in a case of supposed dietetic albuminuria, it is necessary to experiment with various articles of diet, and watch the result.

What explanation can we offer of this form of albuminuria? Obviously it cannot be due to primary change in the secreting tissue, for, although albumen may be very copious, there is no discharge of tube casts or renal epithelium. A chemical alteration of the albumen of the blood, or of its condition in this respect, naturally suggests itself. In regard to the point of these suppositions, however, it must be noticed that it is ordinary serum albumen that is effused, and not, so far as I have seen, any special form. I admit that there may be an undue tendency to the formation of acid albumen or alkali albumen, but this is certainly not the rule. One can understand how, with faulty chemical processes within the body, digestion of nutritive substances and transformations of albumen might be abnormally altered, and albumens more capable of transudation produced, but of the real existence of such a process I know of no sufficient evidence. The excretion of more diffusible forms of albumen, such as propeptone and peptone, is, of course, known to be of not infrequent occurrence, and it may, in some

cases, be related to digestion, but at present we are studying cases in which the ordinary forms of albumen—serum albumen and paraglobulin—are met with.

Apart, however, from any problematic change in the nature of the albuminous constituents of the blood, we have to consider the second stage positively. It is definitely known that changes in some of the other blood elements exert a marked influence upon the filtration of the ordinary forms of albumen. Hoppe-Seyler and others¹ have shown that the quantity of albumen which passes through a filter increases with the increase of the saline constituents. Chloride of sodium is the most efficacious, but nitre, chloride of calcium, and even urea, exert a certain influence. We can readily conceive that, after a meal, the salts of the blood may be increased; it seems possible that this very transudation of the albumen may be induced. The whole question of the influence of salts on the circulation is very interesting. If the attempt be made to pass fluids of various kinds through the vascular system of the kidneys of animals recently killed, it must be granted that it is much easier to pass one rich in salts than simple water. But to this subject I shall allude more in detail on another occasion, and I would say, meanwhile, that, although the fact as to diffusion is well established, its applicability in the explanation of these cases is not yet demonstrated.

While, however, giving these suggestions toward chemical explanations due weight, I cannot but advert to the possibility of reflex vascular influence being at work. We may conceive that, on the entrance of food into the stomach, the terminations of the vagi may be morbidly influenced, or that the nerves supplying the renal vessels respond abnormally to a normal peripheral impression. I have already accentuated the fact that the friend, whose case I have last described, says that as soon as food reaches his stomach the albumen appears, and that the nature of the food ingested makes no difference. One can scarcely suppose that sufficient time has elapsed for absorption, chemical alterations, and excretion, and it seems reasonable to suspect that an influence exerted on the vessels through the nervous system would have more chance of bringing about the result within the time. While throwing out these suggestions, I must admit that our present knowledge does not suffice to afford a satisfactory explanation.

As to the treatment, there is little to be said excepting that such patients must not only be careful as to diet, but scrupulously attentive to all hygienic laws; and that certain remedies, such as the chloride of ammonium or arsenic, may prove eminently serviceable. I should advise looking carefully for evidence of faulty digestion due to defects of different glands subserving the process, and ascertaining whether we can

¹ Senator on Albuminuria, *New Sydenham Transactions*, pp. 97-98, 1884.

discover disorder in the stomach, the duodenum, the liver, the pancreas, or the small intestines. It may be found that only one of them is at fault, and remedies may be applied accordingly. Further, what I have said will suggest the thought that in some cases there may be, not only a digestive, but a nervous influence at work, and that the latter may actually be the main factor in the case; this also may serve as a guide in determining the treatment.

III. I shall now illustrate *albuminuria following upon muscular exertion*, and shall describe its features by narrating a case at present under my care. The patient is a girl, thirteen years old. A sample of her urine, passed on rising at 7.30 A.M., when tested with nitric acid, is seen to contain no albumen, or only the very faintest trace. But the urine passed an hour later, after dressing and moving about the house, but before any food had been taken, is highly albuminous. Thus the getting up is followed by this extraordinary and marked albuminuria. The history of the case is as follows: Her previous health is reported to have been good. About last Christmas, while at a boarding-school, she had an attack of diphtheria which is, like scarlatina, a not uncommon cause of albuminuria by the production of inflammatory Bright's disease. She, however, did well, and went through the whole illness without a trace of albumen appearing in the urine. I can say so with confidence, as I know that particular care was taken in regard to its examination. When, however, she was convalescent, and was getting up and going about the house (but not getting out), albumen was detected. This does not correspond to the ordinary clinical history of albuminuria connected with diphtheria. As a rule, it appears during the attack, or on exposure to cold, within a few days of its subsidence. My own experience in this matter is confirmed by that of others. Dr. John Abercrombie,¹ for example, says that while he has seen it occur within twenty-four hours of the first symptoms of diphtheria, he has never seen it commence later than the tenth day of the disease. During January, a few tube casts were found on two occasions, and sugar was present once or twice in small quantity. At first no peculiarity was observed as to the albuminuria, and so it was of course believed to be constant, and regarded as a result of renal disease due to diphtheria. It was only after some considerable time that it was discovered that the urine passed on getting up in the morning, and also that passed during the night, contained no albumen. This fact was noticed the first time the urine of these periods of the day was separately tested, and from inquiry I find that, although the peculiar periodicity was only then observed, it may have existed from the first, and I think the history and progress of the case make it most probable, in fact almost certain, that it did so. I have said that

¹ British Medical Journal, September 24, 1881, p. 522.

traces of sugar were sometimes discovered in the early period of the illness. No trace of it has ever been detected since the patient came under my care, nor have there been any casts. In a specimen passed on rising, however, we found for the first time a well-marked layer of oxalates deposited on the top of the mucus, and under the microscope octahedral crystals of oxalate of lime were seen in very large numbers. Curiously, in another specimen passed an hour later, there was not a single oxalate crystal; the urine had become alkaline, and there was a pretty copious deposit of triple phosphates.

This patient has now been for a considerable time under my observation, and I can give some interesting details as to the features of her albuminuria and as to some experiments which we have made regarding it. I have already pointed out that the urine passed on rising—and the same has been true, except on one or two occasions, of that passed during the night—contains no albumen or only the merest trace. Now while she is up the albumen is constant, though once or twice toward evening the quantity has been small. But facts as to the daily cycle of the albuminuria are, that the quantity is, as a rule, largest in the morning in the urine passed before breakfast. I have many times examined samples passed forty-five minutes after she got up and before she had taken any food, and have found the albumen in them to be very copious. It would appear, therefore, that the moment she gets up there is a sudden onset of albuminuria, so that this case forms, in this respect, an interesting parallel to that which I have described in the dietetic group, in respect to suddenness of onset, although due to a different cause. During the forenoon the albumen has several times been observed to become distinctly diminished in amount. Sometimes, though not so often, it is in largest quantity later in the day—*e. g.*, during the afternoon or the earlier part of the evening.

I have further tested the conditions of the albuminuria by experiment. On one occasion she remained in bed a whole day and two nights—about thirty-six consecutive hours, keeping her ordinary diet during the time. The result was that the albumen scarcely appeared. Indeed, there was in only one of the samples passed during that period anything more than a mere trace, and in that sample the quantity was small. Curiously, in the urine passed that night after she had been all day in bed, albumen appeared in small quantity. In that passed in the morning there was a mere trace. She then got up and in the urine passed forty-five minutes after, the albumen was found to be present in large quantity,—distinctly larger than it had usually been before. It was again present in small quantity the following night, and there was a distinct trace on rising the next morning. After that, the former cycle became reestablished. Thus the rest in bed, though it greatly diminished, did not entirely prevent the albuminuria; and it was followed by

an increased elimination of albumen when she got up, and a disturbance of the ordinary diurnal cycle. A corresponding result was elicited upon another occasion when the same experiment was tried.

On another occasion an experiment of an opposite kind was made. She was asked to rise at 5 A.M., dress and walk about the house for three-quarters of an hour. The urine passed on rising was free from albumen, whereas that passed forty-five minutes later contained abundance of it. She then lay in bed till 7 A.M. and the urine passed at that time contained no albumen or only a mere trace. She got up, and by 7.45 the albumen was again abundant.

On another morning she was asked to lie in bed and to move about the arms and legs, thus taking exercise in the recumbent posture. This she did for twenty minutes, and the astonishing result was that the urine passed after the time of exertion was, like that passed before it, perfectly free from albumen.

The next morning she was subjected for twenty minutes to very efficient massage in bed, but neither before nor after it did albumen appear.

A warm bath proved equally inoperative. Experiments were also tried with different kinds of diet, and they turned out to have very little effect. She was fed for several days exclusively on milk. It had a marked diuretic effect, and so, the urine being increased, the albumen seemed diminished, but the diminution was merely relative, not absolute. The subsequent addition of an egg daily and some bread and butter to the diet did not produce any evident increase in the albumen. Nor did it increase when ordinary or even rich diet was prescribed.

I have put in a tabular form, on the next page, the most important points connected with the urine in this case. The first table shows the patient's usual cycle, the second the cycle as influenced by experiment. From these experiments it is obvious that the change from the recumbent to the erect posture is at least the main factor in the production of the albuminuria, remarkable as that may appear. Diet has only a very slight effect, and the condition contrasts strikingly with that seen in the dietetic case which I have described. This case also differs from most if not all the so-called cyclic cases which I have seen recorded, in respect to the suddenness of the onset of the albuminuria. In them it commenced, as a rule, gradually and increased during the earlier part of the day, then gradually diminishing toward night, flowing and ebbing like the quiet tide, whereas in our case, though the diminution is gradual, the onset is sudden and abrupt like the tidal wave which is seen in certain rivers.

I have now related most of the facts of the case and will next discuss the question, What is the nature of the albuminuria from which she suffers? Is this young lady affected with, as was at first assumed, a

TABLE I.—REPORT OF EXAMINATIONS OF URINE IN CASE OF ALBUMINURIA FROM EXERCISE, BEGINNING WITH JUNE 20TH.

	Specific gravity.	Reaction.	Albumen Quantitative estimation by Dr. Oliver's percentage method.	Percentage of bile salts normal = 100 per cent.	Urea in grains.
June 20th.					
7.45 A. M.	1023	Distinctly acid.	Trace.	240 or 200	110.6316
8.50 A. M. Before breakfast .	1013	Faintly alkaline.	0.133 per cent.	300+	2.757
10.30 A. M. An hour after breakfast.	(Below average.)	Slightly alkaline.	Less than 0.05 per cent.	300	17.89426
6.30 P. M. After dinner and tea	1029	Faintly acid.	0.13 per cent.	240	38.67
9 P. M. Going to bed . . .	1026	Decidedly acid.	0.06 per cent.	150	66.102
Total . . . . .	.....	.....	.....	.....	236.0548
June 21st.					
Night	1011	Distinctly acid.	Trace.	100	58.93674
7 A. M.	1016.5	Acid.	Very slight trace.	166	64.8
10 30 A. M.	1017	Very faintly acid.	0.24 per cent.	300	24.25

Neither sugar, peptones, nor bile pigment present in any of the specimens.

TABLE II.—URINE, BEFORE, DURING, AND AFTER THE EXPERIMENT OF RISING AT 5 P. M., GOING TO BED AGAIN AT 5.45, AND RISING AGAIN AT 7 A. M.

	Specific gravity.	Reaction.	Albumen. Quantitative estimation by Dr. Oliver's percentage method.	Percentage of bile salts normal = 100 per cent.	Urea in grains.
June 22d.					
9 P. M.	1027	Acid.	0.08 per cent.	240	69.267
June 23d.					
Night	1020	Slightly acid.	Faint trace.	166 or less.	72.5933
5 A. M.	1019	Acid.	Almost imperceptible.	166	29.388
5.45 A. M. Arose at 5 A. M. .	?	Acid.	0.05 per cent.	300	5.6038
7 A. M. In bed since 5.45 .	1013	Acid.	Scarcely perceptible.	240 or 200	17.04713
7.45 A. M. Up since 7 A. M. .	1009	Neutral.	0.06 per cent.	183 (?)	4.4361
2.30 P. M.	1023	Slightly acid.	0.3 per cent.	200	41.40092
9 P. M. Going to bed . . .	1027	Strongly acid.	0.16 per cent.	183	81.13725
Total . . . . .	.....	.....	.....	.....	251.60650
June 29th.					
Night	1012	Acid.	Faint trace.	150	99.2715
7 A. M.	1024	Acid.	Very faint trace.	240 or 200	36.1269
7.45 A. M. Still in bed, before breakfast.	1024	Acid.	Very faint trace.	300	6.6111

No sugar, peptones, or bile pigment in any of the specimens.

hopeless chronic Bright's disease which must almost inevitably send her to her grave before she is twenty, or has she merely an unimportant albuminuria without organic disease, which may, perhaps, disappear when she gets past her present critical period of life, and at all events gives no ground for anxiety? From a careful study of the case, I am convinced that the latter is the correct diagnosis. The grounds upon which I have formed this opinion are:

1st. That there is a period in every day in which the urine is free from albumen;

2d. That the quantity of urine and of urea is normal;

3d. That except on two occasions no tube casts have ever been found; and,

4th. That there is no symptom except the albuminuria at all fitted to suggest the idea of organic renal disease.

I shall now recur to the case of the gentleman regarding whom I have already given some details. The patient is between twenty and thirty and has travelled very extensively, riding and walking a great deal. The earliest symptom of which he complained was a painful uneasiness in the calves of his legs. The most careful examination afforded no evidence of disease in any part of the body, some degree of dilatation of the stomach and the abnormality of the urine alone excepted. On June 5, 1885, I examined six specimens of his water. At 7.30 P.M. the albumen was copious; at 8.50 it was very distinct; at 9.30 A.M. there was a trace; at 10.30 it was distinct; at 12.30, copious. There were no tube casts and the amount of urea was normal. A few days later, after he had recovered from the fatigue of a long journey, I found at 1.50, 3.40, and 5.45 P.M. no albumen; at 7.30 a trace; at 8.30 A.M. a very slight trace; at 10 A.M. a slight trace. I have already pointed out that diet even of a rich, varied, and ill-chosen sort produced no albuminuria. On the other hand, walking, especially walking up hill, induced the symptom. He lived in a hotel in Princes Street and could walk to Charlotte Square with little or no effect on the urine, but if he took a walk to the Calton Hill, the Castle, or Arthur's Seat, the albumen became copious. With rest it gradually disappeared. Carriage exercise seemed to produce no unfavorable effects. Massage, which had been very carefully tried, being thoroughly carried out for forty or fifty minutes by a most competent rubber, was also without result. I tried the effect of exercise in a sitting posture. He sat in his chair and played the banjo for an hour and then used his dumb-bell fifteen minutes. The urine passed immediately afterward was normal, but that voided half an hour later contained albumen. I did not think of trying the effect of muscular movement when he was lying on his back. It was however abundantly clear that muscular exertion, and particularly active walking exercise, was the chief exciting cause in this case also. I need

not again go over the reasons which led me in this case also to give a favorable opinion.

As to the origin of the symptom, it is worth noting that in his travels he once walked through Asia Minor in a wonderfully short space of time, and it was during or after this feat that the albuminuria was first observed. It is very probable that the great strain on his system which his feat implied was the starting-point of the albuminuria, which subsequently, when the damage had been done, could be induced by a much less amount of exertion.

Passing from the illustrative cases, I shall now direct attention to certain other points of interest :

1. The kind of albumen discharged has recently received some attention. Dr. Maguire¹ has recently published 'the results of investigations as to the forms of albumen met with in different diseases, and he concludes that the less grave the case the greater is the amount of paraglobulin in proportion to the amount of serum albumen. In three cases of cyclic albuminuria he found that the albumen present entirely, or almost entirely, consisted of paraglobulin. In a case described as one of anæmia with albuminuria, due in all probability to fatty degeneration of the kidney, both serum albumen and paraglobulin were present, but the latter was in much greater quantity than the former, while in Bright's disease the proportion of these two substances was reversed. On examining very carefully into this question, in the case of the young lady, the serum albumen was found to be in greater quantity than the paraglobulin, and, as it was certainly functional, I cannot admit the universality of Dr. Maguire's conclusion.

2. Another observation as to the kind of albumen present has been made by Dr. Pavy. He finds that sometimes it is not ordinary serum albumen, but alkali-albumen. I am not in a position to confirm this statement from my own observations, but I have been struck with the facility and speed of formation of acid albumen, very slight quantities of acid sometimes preventing coagulation by heat.

3. No peptones, or any other body of that group, have been found in our case, and very little is said of them in cases recorded by others. I observe, however, that Dr. Oliver,² of Harrogate, has met with an instance of intermittent albuminuria, in which peptones replaced the albumen for a time.

4. My patient, though she had no distinct œdema, had a pale, puffy-looking face. This was, I believe, due partly to a general morbid condition of the vessel walls, and partly to the anæmia which often accompanies this affection.

¹ *Lancet*, June 5, 1886, p. 1062, and June 12, 1886, p. 1106.

² *Articles in Lancet*, 1885, vol. i.

5. Occasionally sugar is found. It was detected early in the illness by good observers in both the cases just described; and this fact, as will be seen, lends support to the hypothesis that faulty metabolism may have to do with the production of the albuminuria in such cases.

6. Other chemical changes also occur. Thus phosphates may be present in addition to, or alternately with, the albumen.

7. Urates are sometimes very abundant, and sometimes uric acid is present in considerable quantity.

8. The most common of all the additional chemical abnormalities is the presence of oxalates. They occur, at least occasionally, in a large proportion—I should say in the majority—of cases. It is found that ordinary oxaluria sometimes leads to temporary albuminuria and the presence of tube casts probably by irritating the renal tissues; but, in addition, it should be observed that oxalates very frequently appear in the course of the cases we are considering.

9. The bile salts have been found present in very considerable excess. In the case recorded by Dr. Oliver, to which I have already referred (which may, however, have belonged to the dietetic group), this was so. In the urine they have also been present in marked excess, and my friend, Dr. Stevens, who has devoted much attention to this subject, observed that there has been a diurnal cycle in their excretion corresponding, in the main, to the cyclic character of the albuminuria. This was very distinctly made out when the patient was on ordinary diet, and nothing was done to disturb, in any way, her daily routine of life. The urine passed at night usually contained little more than the small quantity which one expects to find in the urine of healthy individuals. In the urine passed on rising they were in excess, still more in that passed before breakfast, at which time the quantity sometimes reached its maximum for the twenty-four hours. The amount, as a rule, kept up during the day, and diminished toward evening. One interesting fact thus brought out is that the excretion of bile salts began to increase during the morning before rising, so that, whereas the albuminuria appeared to be due to exercise in the upright posture, and to be little influenced by anything else, the excretion of the bile salts was partly influenced by exercise, but partly dependent on some other factor. This is further shown by the circumstance that when she was kept in bed for thirty-six hours the diurnal cycle in their excretion continued to be observed. The appearance of albumen was accompanied by an increase in the quantity of bile salts present.

I may further state that a diurnal variation has been observed by Dr. Oliver¹ in the secretion of the bile salts in health, and his result may be broadly stated to be that the quantity increases during fasting

¹ *Lancet*, 1885, vol i., and *Bedside Urine Testing*, third edition, p. 225.

and diminishes during digestion—falling rapidly after meals. But in this patient's case this is entirely altered. The night urine, during fasting, contains the smallest quantity of all. No doubt it increases toward morning, and still more when she rises before breakfast; but then the quantity keeps up during the day while digestion is going on, and only falls again toward night. A similar change was observed by Dr. Oliver.¹ He found that when albuminuria occurred after a meal the bile salts were excreted in increased quantity, whereas if at any time albuminuria did not occur after a meal the excretion of bile salts was within the normal range. It will be observed that Dr. Oliver found this change in the discharge both of albumen and of bile salts to stand in relation to the diet, whereas in our case it is related to exercise. The two cases are, therefore, not similar, the one being an albuminuria from exercise, the other, as stated by Dr. Oliver, being of hepatic origin. We have in this altered excretion of the bile salts an indication of some morbid change in the chemical or absorptive processes which I shall discuss later on.²

10. The presence of a normal amount of urea and the general absence of tube casts are specially worthy of our notice.

We have now to ask ourselves what explanation our present knowledge enables us to give the cases of this class. While it must be at once conceded that changes of a gross kind in the secreting renal tissues are not very probable, it might be held that molecular alterations of the cells in the Malpighian tufts dependent upon congenital pecu-

¹ Lancet, June 13, 1885, p. 1078.

² Until recently our only method of detecting the bile salts in the urine was that of Pettenkofer by sugar and sulphuric acid. This method, however, owing to the necessity of first extracting the bile salts from the urine, though it might be satisfactory in the hands of chemists, was impracticable as a clinical test. Dr. Oliver, of Harrogate, has devised a method free from this objection, and by which a quantitative estimate can be made. It depends on the fact that the bile salts precipitate albumen or peptone when the fluid is of the requisite degree of acidity, and the test is done in specially graduated tubes with a standard solution of peptone acidified to the proper degree by acetic acid. The solution is, however, difficult to prepare and, if much used, comes to be expensive. A simpler qualitative method, depending on the same property of the bile salts, but requiring no special reagent, has been devised by Dr. Stevens (Ettles Scholar for 1884, and at present one of my assistants, in the course of his clinical work as holder of the Stark Scholarship in Clinical Medicine). The urine, if not albuminous, must first have a little albumen added to it. An albuminous urine does very well for this—care being taken that one is selected which does not itself contain any excess of bile salts. A few ounces of albuminous urine can be carbolized and kept just like other test solutions for any length of time. If now the urine be poured into a conical glass and a little cold nitric acid be run carefully down the side, there will be, if bile salts are present in sufficient quantity, a precipitate of albumen at a certain level in the urine, separated by a clear area from the precipitate of albumen produced by the nitric acid. This upper precipitate of albumen is produced by the bile salts at the level at which the urine has become acidified to the proper degree. A slight reaction may occur even with the small quantity of bile salts present in normal urine and a similar faint precipitate may also be seen in healthy urine owing to the precipitate of mucin by the nitric acid. A little practice will, however, soon enable you to distinguish the slight precipitate which may occur in health from the well-marked and dense precipitate which appears when the bile salts are present in excess. It is, of course, necessary to avoid mistaking a precipitation of urates by the nitric acid for this reaction; should there be any doubt, the effect of heat will set it at rest. As the test is simple and easily done and requires no special reagent, it is well fitted for ordinary clinical work.

liarities might exist, permitting the transudation of albumen along with the water of the blood serum. But I am not aware of any sufficient evidence in favor of such a view, and the conditions under which the albumen appears seem susceptible of a better explanation. There are some considerations which favor the supposition that chemical changes in the serum may be the cause—namely, the occurrence of other morbid states of urine, such as glycosuria, phosphaturia, or oxaluria. Manifestly no change in blood pressure within the kidney or in the walls of the vessels, and probably no changes in renal epithelium could account for these, and it seems necessary to conclude either that the albuminuria and they are common manifestations of a faulty metabolism, or that, independently of alteration in the kidney inducing the one, we have alterations in the liver or other organs setting up the others. The other possible cause of the albuminuria, namely, vascular changes, seems to correspond most readily with the facts observed. The marked influence of muscular exercise and exercise of particular kinds and in particular postures does not seem readily explicable on the chemical hypothesis, while what we know of the physiology of the bloodvessels prepares us to believe that alterations of their lumina and of the blood pressure within them might readily be induced under such circumstances and result in the symptom in question. The occasional occurrence of glycosuria and the excess of bile salts might be advanced as difficulties in the way of this explanation, but it is easy to conceive that a general change in vascular activity which in the kidney induces albuminuria, might, in the liver, induce the other abnormalities. My judgment, therefore, leans toward this hypothesis, but I cannot give positive proof of its correctness.

As to the treatment of this class of cases, rest, judicious diet, and attention to the general health meet the principal indications; but I am anxious to give a careful and extended trial to such remedies as ergot and belladonna, which act upon the muscular fibres of the vessels, and shall not fail to do so as opportunity offers.

IV. I now proceed to consider much more briefly the fourth category of cases—those of *Simple Persistent Albuminuria*. I cannot speak so positively and definitely in regard to them, for on the one hand they are certainly rare, and on the other they are difficult to differentiate from examples of slight chronic organic renal disease; still our conception of this subject would be incomplete if we did not refer to them.

I can recall the case of a student whom I watched all through his University career. He looked quite healthy. No casts were ever found in his urine and the albuminuria was only accidentally discovered. He never had any bad symptom. He successfully went through the arduous work of a four years' course in medicine, which may be taken as a sufficient guarantee that, despite the albuminuria, his health was not

in any way seriously impaired. I cannot be certain that he had no intermissions, but I do not think he had.

I have at present under my care a gentleman, whose case probably is referable to this category. He has persistent slight albuminuria, none of the many specimens passed at all hours having ever been found free from albumen. But he has no tube casts and he discharges a normal quantity of urea. The albumen is scarcely influenced by diet or exercise, although, as is so often seen in all albuminurias, it is least abundant during the night and early morning. There is no distinct increase of vascular tension and no cardiac hypertrophy or other consequent complication of renal change. The only competing diagnosis is slight irritation of the urinary tract, due to an old gonorrhœa from which he formerly suffered. But as there is no positive evidence of this, I incline to think that a simple persistent albuminuria is the most likely cause.

The features of this kind of case I take to be persistent presence of albumen, usually in small quantity, unattended by tube casts, diminution of urea, by increased vascular tension, cardiac hypertrophy or other consequence of renal malady, persisting for a period of months or years and little influenced by diet or exercise. I cannot say whether further experience will confirm this view or not.

The last question which occurs in regard to these cases is as to prognosis. Are these different forms likely to continue simple, or do they culminate in organic renal disease? I think that in the first category there is a slight tendency to this latter issue. In the second and third categories it is less likely. From what has been said by such eminent authorities as Dr. George Johnson,¹ and Dr. Clement Dukes,² we cannot but fear that the condition does sometimes culminate in organic disease, but so considerable a proportion of my cases have gone on for long periods without doing so, that I am confident that it must be rare.

Dr. George Johnson has seen several cases in which, beginning with the simple affection, Bright's disease has developed. He mentions the case of a distinguished London physician, in whom at first albumen only appeared occasionally after walking exercise, and then was present in large amount, while diet had no apparent influence. After a time the albuminuria became persistent, and in the end fatal uræmia resulted. It is, of course, possible, that this was an example of cirrhotic Bright from the first, but when a contrary opinion is held by Dr. Johnson who saw the case, we are bound to conclude that the evidence was strong. Dr. Clement Dukes concludes that many cases are without doubt only transient, that probably many persist for years and yet recover, but he

¹ Dr. George Johnson, *British Medical Journal*, December 13, 1879, pp. 928-930.

² Dr. Clement Dukes, *British Medical Journal*, November 30, 1878, p. 794, and *Idem*, 1881, vol. 2, p. 776.

believes that a large proportion are simply the first stage of Bright's disease.

It must not be forgotten that I have found in some cases of cirrhotic Bright's disease the urine generally free from albumen, that abnormality occurring only when the patient has taken alcohol to excess, has been chilled, or over-fatigued with travelling. But in such cases vascular and cardiac changes, and very probably alterations in the retina will be found, which give conclusive proof of the existence of cirrhosis. Neither must it be forgotten that cases of cirrhosis may show no albumen in specimens passed during the night or in the early morning, while in the day and evening urines it is distinct enough.

The distinguishing features upon which I would insist are the quantity of urea, the presence or absence of tube casts, and the condition of the pulse and heart. These will indicate whether simple albuminuria or organic disease is present, and if these indications are favorable I should give a hopeful prognosis.

The fourth category is one in which my prognosis would be less hopeful. Still, so long as the solids are in the normal quantity, and the vascular changes do not manifest themselves, we may speak hopefully even in such cases.

AN EXPERIMENTAL STUDY OF MYCOTIC- OR MALIGNANT ULCERATIVE ENDOCARDITIS,

FROM THE LABORATORY OF
THE ALUMNI ASSOCIATION OF THE COLLEGE OF PHYSICIANS AND SURGEONS,
NEW YORK.

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It is convenient to group the inflammatory lesions of the endocardium into two classes—first, those in which the more prominent and constant character is the new formation of connective tissue, either in or upon the valves and general endocardium. This form of lesion may be designated by the name of *simple endocarditis*. Several varieties of this lesion may be recognized on the basis of their morphological characters. Thus the valves or the general endocardium may be simply thickened or sclerosed by a new formation of connective tissue, in a manner analogous to the interstitial production of new connective tissue so frequently seen in various internal organs. Or, either with or without a simple sclerosis, there may be irregular thickenings of, or distinct outgrowths from, the

endocardium—most frequently on the valves—in the form of polypoid projections, irregular warty excrescences, etc.

The tissue composing these outgrowths may be dense and firm like cicatricial tissue, or more soft and cellular like granulations, or some of the various forms of young connective tissue. Between these two extremes there may be all intermediate forms, which doubtless represent different phases in the development of the new tissue.

These new growths are liable to ulcerate, to become calcified, to become covered with loosely or closely adherent thrombi, from which emboli—always simple and non-infectious—may be swept off into the bloodvessels, producing infarctions and other disturbances of the peripheral circulation. A local inflammatory reaction may express itself in the accumulation of leucocytes in and about the bases of these outgrowths or so-called vegetations.

In another, an acute variety of simple endocarditis, there may be no new formation of tissue, but the valves and endocardium may be simply swollen and succulent and covered with larger or smaller thrombi; or they may ulcerate and the surfaces of the ulcers may be covered with thrombi.

In contrast to these, for the most part primarily proliferative lesions, stands the second form of endocarditis, namely, the *malignant ulcerative* or *mycotic endocarditis*, in which the dominating morphological and biological factor is the presence of bacteria of one form or another, and the necrotic or ulcerative change which their presence induces. Add to these features the variable inflammatory reaction of the surrounding tissue—which is expressed by the more or less marked accumulation of leucocytes near the seat of necrosis, and the infectious nature of the emboli which are liable to form, and the main characters of the type of endocarditis which form the subject of the present paper, are sufficiently outlined.

The writer means by malignant ulcerative endocarditis a form of lesion always associated with some kind of bacteria. The causative relation of these bacteria to the lesions, and, consequently, the justification of the classification and nomenclature, are points upon which it is hoped that the results of the present investigation may throw some light. However much some of the varieties of simple endocarditis may resemble the mycotic, both clinically and in the gross appearance of the lesions—and the similarity is in some cases exceedingly and puzzlingly close—in view of our present knowledge they seem to be etiologically, and to a certain extent morphologically, entirely distinct. The similarity in the gross appearance is usually due to the more or less voluminous thrombi which may form over the surface of the lesions in both alike. There are cases presenting an acute clinical history in which we find upon the heart valves larger and smaller, more or less abundant vegeta-

tions, sometimes composed in part of new-formed or forming connective tissue and sometimes entirely of thrombi, now without ulceration, and again with a very extensive necrotic process involving large loss of substance and with or without embolism. These may be appropriately called cases of acute endocarditis, or acute ulcerative endocarditis when the necrotic tendencies prevail, but neither the primary nor the secondary lesions contain bacteria, nor, as a rule, does the more or less pronounced stamp of an acute infectious disease prevail, as it is apt to do in cases of malignant ulcerative endocarditis. But one of these forms of endocarditis may be superimposed upon the other, when both clinical and gross morphological features may be very difficult to interpret correctly. It is more especially some of the forms of simple chronic endocarditis upon which the malignant type may be superimposed, and thus may indeed, as it would seem, form one of the predisposing or determining conditions without which the bacterial lesion would not be developed. This point will be considered more in detail further on. Finally, the possibility should be recognized that a proliferative change may occur secondary to the mycotic lesion, and thus bring about a certain degree of recovery.

The steps by which our knowledge of malignant endocarditis has grown are those common to most of the better understood acute infectious diseases. At first it was set aside from other apparently similar or related disorders by a set of clinical characters which were grouped under the general terms, malignant, septic, typhoid. The striking appearance of the heart valves, which presented soft and apparently rapidly formed and often very voluminous vegetations, with a tendency to local necrotic and multiple distant lesions—soon came to be regarded as characteristic of this form of disease. The growth of knowledge concerning embolism and thrombosis and their effects, to which the observations of Virchow so materially contributed, did much to explain both symptoms and lesions.

Very early in this, which may be called the morphological period in the history of this disease, certain very minute granules or corpuscles—masses of which were often seen to be surrounded by a homogeneous area—were detected in the cardiac as well as in the peripheral lesions.¹ These granules were sometimes simply described without speculation as to their nature, sometimes were pronounced, either conjecturally or positively, to be parasitic organisms. But neither the general knowledge upon the subject of microorganisms nor the technical facilities for their study were sufficiently advanced to give these earlier observations much more than an historical interest and importance.

Once turned in this direction, however, the tide of observation swept in numerous data, bearing more or less closely upon the relations of bacteria to this disease. In 1872 Hjalmar Heiberg³ found microorgan-

isms in a case of ulcerative endocarditis in puerperal fever, and his observations were confirmed by Virchow. Eberth⁴ found them in a case of pyæmic endocarditis in the same year, while Virchow wrote at length upon them in an article on chlorosis and endocarditis puerperalis.⁵

In 1873 Eberth,⁶ Wedel,⁷ and Larzen⁸ recorded new observations, and in 1874 cases were added by Eisenlohr,⁹ Burkhart,¹⁰ and Maier.¹¹ Certain granular bodies, which they were reserved in claiming positively to be microörganisms, were recorded by Lehman and van Deventer¹² in 1875. In the following year Gerber and Birch-Hirschfeld¹³ described another case, drawing the analogy with a case of simple pyæmia, in which the general lesions were similar, but the heart lesion was absent.

The impetus of a dominant theory or a very peculiar concurrence of cases led Klebs¹⁴ to the belief that all varieties of acute vegetative endocarditis were of mycotic nature, and, furthermore, that for the rheumatic variety there was one form, and for the septic another form of bacteria. Koster¹⁵ also regarded all acute endocarditis as of bacterial origin, and was led from his observations to the belief that it was due to emboli of the vessels of the valves and endocardium. Litten¹⁶ was, also, of the opinion that all forms of acute endocarditis are of parasitic nature, and reports a number of cases.

At this time Hiller,¹⁷ becoming alarmed at the rapidly accumulating data in favor of the bacterial origin of this disease, felt impelled to throw himself into the breach, and it is not a little curious to observe how many of the arguments which he used in his polemic against the probability of its bacterial origin are just those which most readily fall into line as confirmatory of the results of research at the present time. But steadily with the improvement of the technique of staining the bacteria and the increasing knowledge of their biological characters grew the record of new observations. From 1878–1879 new cases were recorded by Eichhorst,¹⁷ Cayley,¹⁸ Purser,¹⁹ Mygind,²⁵ and Hamburg.²¹ The latter observer examined fourteen cases of acute endocarditis, and found cocci in but four of them. These four cases were all ulcerative, and three were in puerperal fever and one in pyæmia. He found no bacteria in several other ulcerative cases.

At this time Winge² formulated, for the first time, a consistent theory of this disease, based largely upon a carefully observed case, assuming the transportation of microbes from external wounds through the veins to the heart, where, he conjectured, they produced the lesions by lodgement upon the valves. Overbeck,²² in 1881, reports the examination of five cases of ulcerative endocarditis, in all of which were numerous hemorrhages in various organs. In four of these cases micrococci were present, in one they were absent. In the first four cases there were numerous abscesses of the internal organs. In all of these cases there

were old endocarditic lesions. Bramwell,²⁷ in eleven cases of ulcerative endocarditis examined, found micrococci in all.

The writer has for some time been examining the cases of endocarditis which came into his hands—particularly those with an acute history—for the presence of bacteria. The method of staining at first employed was the simple fuchsin staining and decolorization with alcohol. Since its announcement, Gram's method has been used in all cases, and controlled by the simple fuchsin method, as before. The whole number of cases examined was twenty. Of these, seven were of simple chronic verrucous endocarditis; thirteen were cases of ulcerative endocarditis, with a history of acute illness.

Chronic vegetative endocarditis, seven cases. In none of these were bacteria found, either by staining or by culture methods.

Acute ulcerative endocarditis, thirteen cases. In four of these cases the ulcerations, though well marked, were not extensive, and the thrombosis was insignificant in amount. In the remaining nine cases there were extensive ulceration and local thrombosis. In five of these thirteen cases sphæro-bacteria were present in large numbers. In the remaining eight cases they were entirely absent. In four of these thirteen cases cultures were made, one (recorded below) with positive, the others with a negative result. The cases in which a negative result was obtained by the culture methods gave also negative results in the morphological examination. The bacteria were, in all cases, of small spheroidal form, and were morphologically identical. The ulceration and thrombus formations were quite as extensive in the series of cases in which the bacteria were absent as in those in which they were present.

1. *Cases in which bacteria were absent.* In seven of these eight cases there was old thickening of the valves of the left side of the heart. The ulcerations were on the mitral alone in four cases, and on the aortic cusps in four. There was simple infarction of the spleen in two cases, enlargement and softening of the spleen in three. In three cases there was a well-defined previous history of acute articular rheumatism; in five there was no previous history at all. In one case there was purulent meningitis with acute general bronchitis, and in one acute lobar pneumonia.

2. *Cases in which bacteria were present.* In four of these five cases there was old thickening of the valves and endocardium. The mitral alone was affected in two cases; the aortic alone in one; the tricuspid in one; and both mitral and tricuspid in one. The spleen was large and soft in all of the five cases, and there were fresh and old infarctions in four. In two cases there was no previous history, but there was old thickening of the aortic and mitral valves; in one case there was acute articular rheumatism; in two cases pyæmia. In one of the two pyæmic cases—which both resulted from injury—there was malignant osteomye-

litis and periostitis, purulent pericarditis, and thrombosis of the pulmonary artery; while in the other there were multiple abscesses in the brain and kidney, infarctions of liver and spleen, and abscess of the myocardium.

It does not enter into the scope of the present paper to detail the clinical history of these cases, but it may be remarked that the two classes of cases—*i. e.*, those with and those without bacteria—ran courses nearly equal in acuteness and rapidity, and presented symptoms equally obscure.

While in the great majority of cases the bacteria found in the lesions of malignant ulcerative endocarditis are all of the small spheroidal form, a few cases are recorded in which bacilli were present. Such a case is mentioned by Osler,²³ one is reported by Smith and Northrup,²⁴ and one by Netter²⁵ and Martha.²⁵ Cornil²⁶ mentions the occurrence of bacillus tuberculosis in the vegetations in a case of phthisis, as do also Rindfleisch and Kundrat. All of these scattered observations rest, however, upon a purely morphological basis, and bearing in mind how readily the bacilli of decomposition may make their appearance in this situation, if the examination be delayed or the manipulations faulty, our estimate of the significance of the presence of bacilli in a very few cases should be held in abeyance until more detailed and careful observations are at hand.

We now enter upon a new phase in the story of investigations upon this disease. Hitherto the studies recorded have been simply morphological, and the conclusions regarding the significance of the presence of bacteria have been largely conjectural. The very large number of observations coincident in result have made it certain that sphæro-bacteria are very constant factors in certain, but not in all cases of ulcerative endocarditis; but whether they are of etiological importance or only insignificant concomitants, does not yet appear.

In a rather crude way attempts have, indeed, for some time been made to supplement our knowledge of the morphology of these lesions by experiments bearing upon the pathogenic characters of the bacteria so frequently present.

As early as 1870, Winge² made subcutaneous inoculations of animals with particles of the vegetations, but without definite results. In 1872, Heiberg³ made peritoneal and intravenous inoculations, also without positive results. Panophthalmitis and keratitis have been produced in the rabbit by direct inoculation by Eberth,⁶ Birch-Hirschfeld,¹³ and Osler.²³ Grancher²⁸ made some cultures of bacteria from a case of ulcerative endocarditis after rheumatism, but their characters were not sufficiently carefully studied for identification, and they died before inoculations were practised. Perret and Rodet²⁹ report without sufficient detail some inoculations of dogs with vegetations from a case of

acute endocarditis rubbed up with filtered water, and state that vegetations were found upon the valves. They also state that they used fluid cultures with equal success. The account, however, is so lacking in detail and the experiments in precision that one can hardly attach much importance to them, especially as dogs are liable to spontaneous acute endocarditis. But these experiments are all crude and belong to an earlier epoch of research.

The necessity of obtaining pure cultures of bacteria of suspected pathogenic nature and the study of their biological as well as their morphological characters and their effects upon animals, are now recognized as imperative for the solution of such problems as that which now engages us. The use of solid culture media, and particularly the use of gelatine or other form of plate cultures as elaborated by Koch, has placed in our hands the means of isolating such of the bacteria of disease at least as are "facultative" saprophytes and capable of developing and growing in the culture media at present known to us.

A series of cultivation and inoculation experiments made by Hare,²⁷ and recorded in a recent number of this journal, gave negative results. Unfortunately, the bacteria, which were cultivated from the kidney abscesses of one of Bramwell's cases, in gelatine bouillon tubes and on potato appear to have become contaminated and were neither identified nor fully described. It does not appear from the text that the gelatine plate method of Koch was resorted to for separating and identifying the bacteria presumably derived from the heart lesion, and without this such a series of experiments could hardly be expected to yield permanently valuable results.

Impressed with the importance of the biological method of research, Wyssokowitsch,³⁰ under Orth's direction, recently instituted a series of experiments which led to unexpected and positive results. He started with the fact recorded by Ottomar Rosenbach³¹ in 1878, namely, that a traumatic injury to the heart valve of the rabbit by means of a sound introduced through the carotid is not followed by an inflammatory reaction, and by no or but a very slight thrombosis.* Then choosing, somewhat at random, the well-known pathogenic organisms, the significant relations of which to pyæmia and the suppuration process have been so thoroughly studied, namely, *Streptococcus pyogenes*, he introduced pure cultures of

* These results of Rosenbach's experiments, showing the comparative tolerance of the endocardium toward mechanical interference, recall a notion, formerly widely entertained, that the endocardium was an exceedingly sensitive structure; and in the early days of the accumulation of knowledge concerning pyæmia it was held by some that the chills were produced by the irritating effect upon the endocardium of the entrance of pus into the heart.

Bichat recommended in cases of asphyxia to stir up the heart by passing a sound down a vein of the neck and tickling the endocardium. This was actually done by Dieffenbach in cases of Asiatic cholera with collapse, but without effect. Virchow found, however, by introducing into the heart glass sounds, pieces of ice, meat, etc., that the endocardium was quite insensitive. Virchow, *Gesammte Abhandlungen*, p. 229.

these into the vein of the ear of the rabbit, soon after having produced the injury to the heart valves as above described. The seven rabbits operated upon died in from one to eleven days—at the latter period when a very small quantity of the inoculating material was used. In five of these animals numerous larger and smaller vegetations were found near and in some cases somewhat distant from the seat of injury, both where the valve was perforated and where the sound had evidently touched the endocardium. These vegetations consisted of large numbers of sphæro-bacteria similar to those injected, a little fibrin, and red blood-cells. Beneath these was a distinct necrotic area, which grew larger as the bacteria made their way into the tissue from the surface. In some cases there were pericarditis and cardiac abscesses. Metastases in the kidneys, spleen, and knee-joint were noted. Suppuration around the bacterial masses was not observed. In one case in which the injection of the bacteria was delayed for forty-eight hours, no such changes in the endocardium were observed. In the other case the operation was unsuccessful, and the experiment vitiated by the chance introduction of some contaminating bacteria of another species.

After these striking results, Wyssokowitsch repeated the experiments, using for inoculation cultures of the bacteria so frequently associated with the streptococcus in pyæmia and the suppurative process, namely, *Staphylococcus pyogenes aureus*. Three rabbits were inoculated after the preliminary operation: two with a concentrated and one with a much diluted emulsion of the bacteria. The first two died on the first and second days and presented lesions in general similar to those induced by the streptococcus, except that the bacteria were not so abundant and not in such large masses in the lesions, and the suppurative process near their seat of deposit was well marked. The third rabbit died thirty-eight days after the operation, and presented no lesions, except the original puncture of the valve. Following this one rabbit was operated on in the same way, and immediately inoculated with the coccus sepsis of Nicolaier. It died on the fourth day, and the results were essentially the same as with the streptococcus. A local infection of one side of the left auricle, which was in contact across the cavity of the auricle, with a vegetation evidently the result of the extension of the process from the injured valve through the heart wall, gave an excellent example of the extension of the process *per continuatatem* as well as *per contactum*.

The original results of Rosenbach were confirmed by operations on four rabbits. Two rabbits were inoculated after the operation on the valves with micrococcus tetragenous and two with the *Bacillus pneumoniae* of Friedländer, but with entirely negative results.

Finally, Wyssokowitsch succeeded in obtaining pure cultures of bacteria from a fresh case of malignant ulcerative endocarditis in man with metastatic lesions. Those obtained by the usual plate culture method

presented all the characters of *Staphylococcus pyogenes aureus*. Cultures from this case gave, by a repetition of the above operation, results identical with those obtained in the use of the same species from another source.

Shortly after the announcement of these results by Wyssokowitsch, Weichselbaum³² published the results of his examinations of three cases of malignant ulcerative endocarditis, and one case of acute vegetative endocarditis. The three cases of ulcerative disease were young females, two with rheumatism and one with a history of old valvular lesions. In one of these cases he found and cultivated for identification from the pericardial fluid, the cardiac vegetations, spleen and urine, a mixture of *Staphylococcus pyogenes aureus* and *albus*, and *Streptococcus pyogenes*. In another case he cultivated from the vegetations *Streptococcus pyogenes*, while in the third case he identified only the *Staphylococcus pyogenes aureus*. In the case of acute vegetative endocarditis, which was that of a young rheumatic female, he identified *Streptococcus pyogenes* only. His experiments on animals, of which the details are not yet published, gave, he states, results essentially identical with those of Wyssokowitsch.

While the work of Wyssokowitsch and Weichselbaum was going on, and especially after their results were announced, Ribbert³³ was studying the subject with a somewhat different technique. He omitted the preliminary direct mechanical injury to the endocardium, and introduced potato cultures of *Staphylococcus pyogenes aureus* directly into the veins of rabbits. At first he scraped off the superficial growth of the culture with a little of the potato, and ground them fine before the injection; his results in this way were inconstant. When, however, he injected with the bacteria larger particles of the potato among and into which they had grown—particles as large as would pass the canula of the injecting syringe—and used quite large quantities, he was able to produce not only cardiac abscesses and areas of necrosis in the myocardium, but most marked vegetations upon the endocardium, especially on the mitral and tricuspid valves. The vegetations were most apt to be at the points of attachment of the chordæ tendineæ to the valves, and on the outer surface of the valves; they were never found on the aortic and pulmonary valves.

Microscopical examination showed the various stages in the development of the endocardial lesion. At first there was a simple lodgement of the bacteria upon the surface of the endocardium—in a few cases a particle of potato was found on the surface with the bacteria clustered around it. The bacteria gradually penetrated the underlying tissue, causing a local necrosis over which the thrombus formed. For the details of the microscopical study we must refer to the original. In a word, Ribbert obtained essentially the same results as Wyssokowitsch

and Weichselbaum by introducing with the bacteria a foreign substance, which apparently either produced the necessary mechanical injury or brought about the adherence of the bacteria to the endocardial surfaces. By his method of experimentation, however, it is necessary to use larger quantities of the inoculating material, a proceeding which is always undesirable when conclusions, bearing upon similar lesions in man, are to be drawn from the results.

Ziegler³⁴ identified the sphæro-bacteria in one case of malignant ulcerative endocarditis as *Staphylococcus pyogenes aureus*.

Striking and momentous as are the results of the just recounted experiments, it is obviously of the highest importance that they should be repeated under varying conditions, and that the sphæro-bacteria now so frequently found in ulcerative endocarditis in man by the improved methods of staining, should be more precisely identified and in every suitable case studied by the methods which the solid culture media of Koch have placed in our hands.

The primary purpose of the writer in the experiments now to be recorded, was to repeat independently and from the beginning the experiments of Wyssokowitsch in so far as they could be done with the fully identified bacteria derived from a case of human malignant ulcerative endocarditis.

All of the bacteria used in these studies were derived from a case for the organs and history of which the writer is indebted to the courtesy of Dr. George M. Swift, of New York.

Mary C., aged fourteen years. Had convulsions at eighteen months, scarlatina early in life but no rheumatism, and was apparently well and strong. She was admitted to hospital February 22, 1886, for operation on clubfoot. Cuneiform osteotomy was performed "antiseptically" on February 26, and for the first few days patient did well but complained of pain in the foot. On March 6, there was an erysipelatous redness about the wound and the temperature rose, but was reduced by antipyrin. She became delirious at times and unconscious; had twitching of muscles on left side, and died on March 10.

Autopsy. *Brain*: Meninges apparently normal, ventricles not dilated. Numerous small sub-pial hemorrhages, mostly quite superficial, on cerebral convolutions. A few hemorrhages were at the bottom of the sulci, and some of these involved small areas of the gray matter, which about them was soft and red. *Heart*: Pericardium normal. Aortic and pulmonary valves normal. Scattered along the edges of the tricuspid and mitral valves and nearly completely investing them, were irregular rows of larger and smaller, white and red, firm and closely adherent excrescences, some of them covered with loosely hanging red and white thrombi. On one of the papillary muscles of the left ventricle was a small eroded area loosely covered with a thin red fibrinous pellicle. In the left ventricle were also numerous small subendothelial petechiæ and one small abscess. *Lungs* normal. *Spleen* soft and large, and presented an irregular grayish friable area about one centimetre in

diameter. *Kidneys* moderately large, capsule free, studded with numerous small yellowish-white spots surrounded by zones of diffuse redness. On section, the cortices were thickened, light in color, markings obscure. Everywhere, both in cortex and medulla, the cut surface was thickly besprinkled with small yellowish-white spots and streaks. The spots were from one to three millimetres in diameter and many of them were surrounded by a sharp red zone. There were also numerous sharply circumscribed red spots. *Liver* presented several larger and smaller white irregular areas, some of them very soft, having the appearance of infarctions. Other organs appeared normal.

Microscopical examination. The tricuspid and mitral valves are irregularly thickened, the new tissue being mostly dense and firm, and consisting largely of basement substance. In the superficial portion, however, the cells are more abundant and fusiform, stellate, and spheroidal. The surfaces of these—for the most part apparently old vegetations—are irregularly bestrewn with larger and smaller masses of very small spheroidal bacteria arranged in pairs or in large or small irregular clusters, or lying singly. They stain readily by Gram's or by the simple fuchsin method. These bacterial masses are in part covered—in part intermingled with granular matter, a few leucocytes, fibrin, and a few red blood-cells. Beneath the mass of bacteria there is in most cases a larger or smaller area of necrosis of the vegetation in which the nuclei remain unstained, and the basement substance presents a translucent, finely granular, or structureless appearance. In many places there is an irregular zone around the areas of dead tissue in which there is a greater or less accumulation of leucocytes. In general, the necrotic process in this case is not advanced, involving only little spots here and there on the surface of the vegetations where the tiny masses of bacteria have found lodgement.

The lesions of the other internal organs were those common to pyæmic abscesses and infarctions.

The kidney presented microscopically a variety of phases in its lesions corresponding to the varied gross appearance. In some places the larger, but particularly the smaller bloodvessels were plugged by masses of bacteria with little or no reaction of the tissue about them. In other places the bacterial masses were surrounded by a zone of dilated bloodvessels. Again, there was localized necrosis around the bacterial plug, while around this necrotic area there was sometimes simply a zone of enlarged bloodvessels, or an accumulation of leucocytes, or both. In some cases the bacterial mass was closely surrounded by an accumulation of leucocytes, so dense that the kidney tissue for some distance around was entirely concealed, or completely broken down. The liver and spleen presented the usual effects of infectious emboli. The brain showed microscopically a plugging of the smaller bloodvessels in the hemorrhagic areas with bacteria, while around these plugs were either a simple zone of dilated bloodvessels, or extravasation, or a localized breaking down of brain tissue; or, in a few cases, an extravasation of blood surrounded by a zone of purulent infiltration. Finally, in some places, the brain tissue surrounding the bacterial embolus appeared to be simply necrotic, without hemorrhage, and without inflammatory reaction.

Some portions of the kidney were placed in a covered sterilized jar, and allowed to stand at the temperature of the room for twenty-four to

sixty-six hours. Stained sections made at various intervals from carefully removed fragments of these pieces showed, in the most evident manner, a large and steady increase in the number of bacteria. The bacteria, furthermore, were no longer, as in the freshly hardened tissue, mostly confined to the bloodvessels and the abscess, but were in the lumina of the tubules and outside of the vessels in the cavities of the glomeruli. This increase in the number of pathogenic bacteria in the tissues after death,³⁵ which is now a well-established fact, is too often overlooked, and should always be taken into consideration, not only in estimating the number of bacteria present in any given case, but also in determining the positions which they occupy.

The organs were received in a very fresh condition, and with a most strict adherence to the usual antiseptic precautions, several peptonized gelatine plate cultures were prepared in varying degrees of dilution from the vegetations of the valves and from several of the renal abscesses. At the ordinary temperature of the laboratory at the end of the second day numerous colonies were just visible to the naked eye. Under a low magnifying power these colonies presented sharp edges, were moderately finely granular, of a slightly brownish color, and had just begun to liquefy the gelatine around them. No other forms of colonies appeared in the plate, except an occasional aërial surface contamination. From these plate colonies, gelatine, agar, and blood-serum tubes and potatoes were inoculated. In gelatine tubes the culture medium became gradually fluid with a whitish pellicle on the surface, which gradually assumed a light yellow color, and soon sank to the bottom. The liquefaction progressed until the entire mass was fluid, and as this went on the gelatine itself became darker in color, and the bacterial sediment of a deeper yellow. On agar the growth in the thermostat at 37° C. was rapid, spreading usually from the line of inoculation for from one to three millimetres over the surface, and growing less vigorously along the puncture line. The surface growth, at first white, gradually assumed a more or less bright yellow color, particularly in the older parts. Along the puncture line the growth remained white. The agar was not liquefied, and the yellow color became more intense as the culture grew older, finally deepening to a rich orange. On blood-serum a yellow pellicle formed without fluidification. On potato the growth was slow at chamber-temperature, gradually assuming a light or deep yellow color. The gelatine and agar cultures were transplanted through many generations, their characters remaining unchanged.

Six rabbits were inoculated subcutaneously with about two cubic millimetres of an agar culture. Five of these developed abscesses which contained the same bacteria. The sixth rabbit presented no reaction. Injection of about the same quantity of the culture mixed with sterilized three-quarter per cent. salt solution into the pleural and abdominal cavities of three rabbits, were followed by a rise of temperature of from one to three degrees on the two following days and after this there was complete recovery.

It will be seen from this *résumé* of the characters of the bacteria cultivated from the heart vegetations, and from the renal abscesses in a case of malignant ulcerative endocarditis in man, that they were the *Staphylococcus pyogenes aureus*, which is so frequently associated with pyæmia

and the suppurative process.³⁶ This, it will be remembered, is the same species which Wyssokowitsch found in his one case, Weichselbaum in two of his four cases, and Ziegler in one case of this disease.

An unlooked-for confirmation of the pathogenic properties of these bacteria occurred in the person of one of the writer's associates in the laboratory. He was inoculated in the finger from handling the abdominal viscera of one of the rabbits dead on the second day after an intravenous injection of a pure culture. He suffered for several days from a severe phlegmon of the finger, with great tenderness of the lymphatic glands of the entire body. On opening the abscess of the finger which rapidly developed, about one drachm of pus was discharged, from which with the greatest ease the same *Staphylococcus pyogenes aureus* was cultivated.

ANIMAL EXPERIMENTS.—These were performed exclusively on rabbits.

Punctures of the valve without subsequent inoculation. At first five rabbits were operated on by Rosenbach's method, for the sake of control, as follows:

The animal being narcotized or anæsthetized was stretched on the Czermak table with the neck raised by a block of wood so as to straighten the carotid as much as possible. The hair was removed over the right carotid region and the skin thereabouts carefully cleansed with sublimate solution 1:1000. The carotid was now exposed for an inch of its course, and two ligatures passed around it about three-quarters of an inch apart. The distal ligature was drawn tight and tied, while the proximal was left loose. A V-shaped opening being now made with scissors in the carotid, a small silver probe, carefully sterilized by heat, was passed into the vessel and by a little manipulation carried downward. When the semilunar valves were reached a slight resistance was observed. This was readily overcome by a moderate pressure on the probe which readily punctured one of the cusps. At this moment the heart usually bounded and its beats became irregular and very rapid. On the withdrawal of the probe the proximal ligature was tied, the wound washed thoroughly with sublimate solution, closed by sutures, and bandaged with absorbent cotton and flannel. A blowing sound could in most cases be distinctly heard after the valve puncture, and the heart beats remain for a few hours frequent but regular.

Very little blood was lost in these operations and the animal rapidly recovered spirits and appetite. The wound healed in all cases by first intention, when the animals were allowed to live long enough, and on killing them at periods of from twenty hours to thirty-six days, no marked reaction was found at the seat of puncture of the valves or in the internal organs. The edge of the somewhat ragged opening in the valve was in one case loosely covered by a filmy clot. After a few days the edges of the puncture became smooth and slightly thickened, and so remained up to the latest period at which the animals were killed, namely, thirty-six days.

Conclusions. Simple puncture of a cusp of the aortic valve in rabbits with a sterilized probe introduced under antiseptic precautions through the carotids, is followed by no result other than a slight thickening of the edge of the puncture through the valve.

Punctures of the valve followed by inoculation. Following the method of Wyssokowitsch, eight large, healthy rabbits were operated on in the manner just described, and after from one to three hours a varying quantity of the cultures of the *Staphylococcus pyogenes aureus* from the above case of malignant ulcerative endocarditis was introduced by means of a sterilized Koch's balloon inoculating syringe into the vein of the ear. For this purpose not less than one cubic centimetre of a fluidified gelatine culture, or from one to two cubic millimetres of an agar culture was used, mixed with a small quantity of three-quarter per cent. salt solution.

One of these rabbits died in sixteen hours, and showed a broad scratch at the lower end of the carotid, and a simple puncture of one of the cusps of the aortic valve. There was congestion of the lungs, but no other lesion. In one other animal the temperature rose to $104\frac{2}{3}^{\circ}$ on the second day, and the animal seemed dull and ill, but on the third day the animal appeared well, and continued so until the twenty-sixth day, when it was killed. There was a simple puncture of the valve with slightly thickened edges and numerous calcareous deposits in the kidney, but no other lesions.

The operation on the remaining six animals gave positive results, which were so nearly similar that they may be summarized as follows: The temperature rose from $103\frac{1}{2}^{\circ}$ to 105° during the first few hours, and usually continued elevated until within a few hours of death, when it fell to normal or below. The animals, for the most part, refused food, appeared stupid, and disinclined to move, and toward the end grew very weak, and scarcely able to sit upright. A feeble convulsive movement of the entire body frequently immediately preceded the death, which occurred, on the average, in from forty to fifty-five hours.

In all cases the wound in the neck was dry and healing favorably. In four cases there was sero-fibrinous pericarditis, and the exudation contained numerous sphæro-bacteria, which morphologically and by culture were identified as *Staphylococcus pyogenes aureus*. In four of the six cases a cusp of the aortic valve was punctured, while in these and in the two others there was a line of roughening along the lower end of the carotid and on the endocardium below the valves in the line of passage of the probe. It will thus be seen that in two of the six positive cases the probe had slipped between the valves, injuring the endocardium below and the aorta above.

In all of the six cases, along the line of carotid erosion, around the seat of puncture, or on the surface of the injured valves, and on the

endocardium below, were larger and smaller, irregular elevated masses, resembling fresh cardiac vegetations.

On microscopical examination these vegetations were found to consist of masses of sphaero-bacteria, intermingled with fibrin, granular matter, and a few red and white blood-cells. The larger of these vegetations rested on a more or less evidently eroded endocardial surface.

The microscopical examination of the endocardium and inner surface of the carotid near the points of contact of the probe, and sometimes for some distance from it, revealed tiny elevations of similar character, but so small as to be scarcely, or not at all, visible to the naked eye. Among these smaller elevations could be traced all intermediate forms between the simple deposit of a tiny cluster of bacteria on the surface of the endocardium, and well-marked vegetations, in which the bacteria were intermingled with fibrin and granular material, and rested on a necrotic base. The localized necrosis of tissue in the immediate vicinity of the clusters of bacteria, both large and small, was a very marked feature in all of these experimental cases. In many cases, not only the fibrin around the bacterial masses, but the endothelium and subendothelial tissue, to a varying depth, were converted into a structureless or finely granular material, which did not stain.

In one case there was a moderate proliferation of the endothelium at the outer border of the necrotic area, and in many, especially when the life of the animal was prolonged, there was a zone of small spheroidal cells at a short distance from the necrotic region in the subendothelial tissue.

In one case the heart muscle was thickly beset with tiny abscesses, some of which projected beneath the endocardium. In two other cases, one and two small subendocardial abscesses were found. Microscopically these abscesses consisted of pus cells and fragments of necrotic muscle fibre which had lost their striation, while bacteria were found either within the abscess, or at a short distance from its border, and blood-vessels could be readily demonstrated the lumina of which were completely plugged with them. The very early period after inoculation—sometimes within thirty hours—at which these abscesses may be fully formed, is worthy of note.

The right auricle and ventricle in most of these cases were distended with voluminous loose red clots in which numerous bacteria had lodged. These were identified as the same species as those inoculated.

The lungs were, as a rule, normal, as was also the liver, but in one case the latter organ presented a large infarction involving the anterior border.

The spleen was uniformly enlarged, frequently to twice or thrice its normal size, and soft. It contained the same bacteria.

The kidneys were congested and in all but one of the six cases pre-

sented several large infarctions. In one case they were studded with larger and smaller abscesses.

The microscopical examination of the kidney revealed most exquisite forms of pyæmic abscesses and infarctions. Larger and smaller blood-vessels were plugged with masses of sphæro-bacteria, in some cases with no alteration of tissue around them. Or, directly surrounding the bacterial mass there would be a larger or smaller area of necrosis; while these necrotic areas were in turn, in many cases, enclosed by a wide or narrow zone of purulent infiltration. The origin of the infarctions could in many cases be most readily demonstrated in the plugging of larger vessels by enormous masses of bacteria. Partial or nearly complete injection of the vascular tufts of the glomeruli with bacteria was of frequent occurrence.

In one case there was a gangrenous area of about one inch in diameter in the large intestine. The only brain lesion noticed was a moderate congestion in three cases.

In the above mentioned case of this series, in which the animal was at first ill, but afterward recovered, and was killed on the twenty-sixth day, the kidneys were thickly beset with larger or smaller calcareous masses, mostly elongated and more or less contorted. These encroached upon the kidney tissue in their vicinity, which was thickly infiltrated with small spheroidal and elongated cells, and were apparently the result of recovery from the original renal emboli.

In all of these cases gelatine plate cultures were made from the heart and kidney lesions, and the pure cultures thus obtained were used in continuing the inoculations from one animal to another. It was from one of the later cultures in the series that the above mentioned human inoculation occurred. Thus the bacteria, which so promptly produced the severe phlegmon of the finger, originating, so far as these experiments go, in the heart valves of a case of human malignant ulcerative endocarditis, had passed successively through three rabbits, producing death in each case, and through almost innumerable generations in the culture tubes and plates.

Conclusions. This series of experiments shows, in confirmation of the results obtained by Wyssokowitsch, that the introduction into the blood of rabbits of a considerable quantity of a pure culture of *Staphylococcus pyogenes aureus*, after a mechanical injury to the endocardium, is capable of producing, in addition to the peripheral changes characteristic of pyæmia, the typical lesions of malignant ulcerative endocarditis, and that the seat of these cardiac lesions is determined by the position and extent of the mechanical injury to the endocardium.

Chemical injury to the endocardium followed by inoculation. In order to ascertain the effects of chemical irritants in rendering the endocardium vulnerable to the action of the bacteria, I have varied the preliminary

operation by arming the point of the probe with a fused mixture of equal parts of silver and potassium nitrate, covering this with a thin coating of sugar and passing it down the right jugular vein. The point of the probe may be brought to any desired position, after a little practice, before the sugar dissolves, and thus the mitigated caustic may be rubbed against the endocardium, the parts above having been protected by the film of sugar. The point of the probe may be held against the wall of the right auricle, or carried between the leaflets of the tricuspid valve, or pushed down into the ventricle. A small, firmly adherent thrombus usually, but not always, forms at the points of contact of the silver salt with the endocardium and into this thrombus the bacteria make their way, or in its absence lodge on the endocardium and induce lesions similar to those above described as following a mechanical endocardial injury. Hemorrhages and abscesses of the lungs are more frequent after these operations on the right heart, but otherwise the peripheral lesions are the same as those above described. Seven rabbits were operated on in this way with identical results.

Conclusions. The action of chemical agents upon the endocardium in the rabbit produces a condition of predisposition to the lodgement and growth of *Staphylococcus pyogenes aureus* similar to that induced by a simple mechanical injury.

For the purpose of control, two rabbits were operated on by passing a sterilized probe down the jugular into the right heart, allowing it to remain there for a few seconds and then withdrawing it and closing the wound. After this, on introducing the usual dose of *Staphylococcus pyogenes aureus* culture into the blood through the ear vein the animals died with renal infarctions and swollen spleen, but there were no heart lesions.

Chemical injury to the endocardium not followed by inoculation. In three rabbits, the sterilized probe armed with silver nitrate was introduced into the heart through the jugular and its point rubbed against the tricuspid valves and endocardium until the silver salt was dissolved. It was then withdrawn and the wound closed. These animals remained apparently well and were killed, one in twenty minutes, one in five, and the other in six days. In the animal killed after five days there was a slight loose red and white clot adherent to the edges of the tricuspid valve. In the other animals there was no clot and no apparent change in the endocardium. Microscopical examination of the clot showed no bacteria.

Conclusions. These control jugular experiments show that a simple light contact of a sterilized probe with the endocardium of the right heart does not, in rabbits, produce a sufficient injury to that structure to determine a localization of *Staphylococcus pyogenes aureus* in the heart after a subsequent intravenous injection of them; furthermore,

that a simple chemical injury to the endocardium, such as is produced by the contact of silver nitrate, not followed by bacterial inoculation, does not, in rabbits, produce the lesions of endocarditis.

SUMMARY.—Bacteria are frequent in a certain proportion of cases of acute ulcerative endocarditis in the cardiac, and, when these exist, in the peripheral lesions. These bacteria are small and of spheroidal form in almost all of the cases thus far described; but in a few cases the presence of bacilli has been noted. There are cases of ulcerative endocarditis with extensive destruction of tissue and large formation of thrombi, in which the lesions are entirely free from bacteria. In these cases, as a rule, the endocardium is the seat of an old inflammatory process and the peripheral embolisms, infarctions, etc., do not contain bacteria.

In many cases of acute ulcerative endocarditis associated with bacteria the valves and endocardium are also the seat of old inflammation.

The destructive process and formation of thrombi in the heart valve and endocardium may be as marked and extensive in the cases in which the bacteria are absent as in those in which they are present; but in the latter class of cases the embolic lesions which are apt to be developed are of an infectious nature, and the general course of the disease is apt to bear the stamp of an acute infectious disorder.

These two classes of cases may be appropriately designated as *ulcerative* or *acute ulcerative endocarditis*, but those in which the bacteria are present should be distinguished by the term *malignant bacterial* or *mycotic ulcerative endocarditis*.

The gross appearance of the valvular lesion does not always or usually enable us to distinguish between these two forms of disease. Bacteria are sometimes present in cases of acute vegetative endocarditis, but in the lesions of chronic proliferative endocarditis they do not appear to occur at all.

The bacteria which are present in the cardiac and peripheral lesions in cases of malignant ulcerative endocarditis are the causative factors in the disease. This has been shown by three independent observers, who have isolated the same species of bacteria from cases of this disease in man; obtained them in quantity in pure cultures; induced in rabbits by their inoculation, under special conditions, lesions of the endocardium as nearly identical with those in man as the nature of animal experimentation will permit; and finally determined the presence of the same bacteria in the cardiac and peripheral lesions of the operated animals.

The bacteria apparently produce the cardiac lesions by lodgement on the surface of the valves and endocardium, when the latter are rendered vulnerable to their action either by mechanical or chemical injury; or by the presence of old inflammatory alterations; or by conditions unknown to us.

Bacterial embolism of bloodvessels of the heart valves is apparently not of frequent occurrence, as was formerly believed.

The only bacteria which have been thus far absolutely identified as occurring in the lesions of malignant ulcerative endocarditis in man are *Streptococcus pyogenes* and *Staphylococcus pyogenes aureus*. This identification has been made in six cases.

It has been demonstrated that other species of bacteria than those above mentioned are capable of causing similar lesions in rabbits under similar experimental conditions.

REMARKS.—The relations of malignant ulcerative endocarditis to the acute diseases such as pneumonia,* typhoid fever, etc., in connection with which it is apt to occur, still remain obscure, and in the light of the new methods are almost entirely unstudied. It is, however, noteworthy that in all the cases of this disease thus far fully studied by biological methods, the bacteria identified are those which play so important a rôle in pyæmia and the inflammatory processes in general. In these cases the disease may be regarded as one of the local lesions of pyæmia.

The great frequency with which the acute ulcerative disease is engrafted upon an old endocardial lesion would seem to indicate that in the human subject the absence of endothelium, or the roughness of the surface of the thickened endocardium, affords conditions of predisposition for the lodgement, and vulnerability toward the incursions of the bacteria, where once they gain access to the blood, similar to those produced experimentally in the rabbit by mechanical or chemical means.

To seek for the nature of the acquired vulnerability in a diminished vitality of the endothelial cells whereby they become unable to cope successfully with the ptomaine-producing bacteria which find lodgement upon or near them, would lead us in a direction toward which many experimental data point; but it is perhaps better, for the present, to remain on what seems to be fully established ground. The injection of *Staphylococcus pyogenes aureus* into the blood of the rabbit may cause death by pyæmia, but it does not induce malignant ulcerative endocarditis. Simple chemical or mechanical injury to the valves and endocardium does not induce endocarditis. Perform both operations at once and the disease almost invariably follows.

This predisposing factor in disease, which has long been recognized, has become more evident and demanded a more precise comprehension since the causative relationship of microorganisms to certain diseases has

* Some recently recorded experiments by Netter on ulcerative endocarditis associated with acute lobar pneumonia (*Archives de Physiologie normale et path.*, Aug. 15, 1886, p. 106) contain interesting and important data. But the meagreness of detail in the record of his experimental work, the uncertainty which still exists as to the significance of the various so-called pneumococci, and the far-reaching deductions which he makes from experimental procedures by no means free from grave technical errors, seem to render unnecessary at present a more extended consideration of his paper.

been established. In the disease before us, the gross nature at least of the predisposing factor is very simple and evident. In other diseases—tuberculosis or pneumonia, for example—the conditions are much more subtle and difficult of definition but none the less important.

In the search after these predisposing conditions in diseases already proven to be immediately due to the action of bacteria, such a vast amount of labor remains to be performed, both in the clinical, physiological, and morphological departments, that it becomes evident that the whole field is by no means won, as is too often assumed, when a disease is demonstrated to be of bacterial origin.

The immediate duty of observers of malignant ulcerative endocarditis from the etiological standpoint is evidently to study every suitable case completely by the biological as well as the morphological methods and thus ascertain the exact characters of the bacteria involved.

Finally, in view of the significant relationship of the bacteria of pyæmia and suppuration to malignant ulcerative endocarditis in the cases thus far fully examined, it is evident that a demonstrably diseased condition of the heart valves, or a previous history which would suggest the possibility of such a condition, should be an additional incentive to the practice of a vigilant antiseptis in operations, however simple, upon this class of cases.

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ACTINOMYCOSIS HOMINIS.

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ACTINOMYCOSIS is defined by Ziegler as a progressive inflammatory affection, set up by a certain fungus—the actinomyces; resulting in the formation of granulations and fibrous tissue, and in suppuration; attacking human beings, cattle, and swine; and communicable to cattle by inoculation.¹

The disease as occurring in cattle was first described by Bollinger, in

¹ The most complete account of this disease hitherto given is that by Israël, in the *Klinische Beiträge zur Kenntniss der Aktinomykose der Menschen*, Berlin, 1885, an abstract of which, by Dr. Whiteside Hume, has been published in the New Sydenham Society's volume entitled *Bacteria in Relation to Disease*, edited by Mr. Watson Cheyne.

1877, as a condition in which sarcoma-like tumors were met with, associated with a peculiar growth which, from its structure, was named the ray-fungus, or actinomyces. In man this organism was observed and described by Israël in 1877, but it appears that Ponfick in 1879 was the first to recognize the true nature of the disease, and to establish its identity with the condition previously described by Bollinger as met with in cattle.

The fungus occurs as small globular masses, commonly about the size of a millet-seed, usually of a pale yellow color, but at times white, brown, green, or speckled, with a surface closely covered with palisade-like rows of clubbed bodies which give it a mulberry-like appearance. Each mass consists of a central core of closely woven threads, from which radiate a multitude of filaments which swell out at their ends into the club-shaped bodies before mentioned; these form the outer part of the mass, and cause its peculiar appearance. In man the clubbed bodies are commonly absent, and the growth consists of the radiating filaments alone. If seated in the tissues, each portion of fungus is surrounded by inflammatory products forming a nodule which in its structure may exactly resemble a tubercular granulation. If this is of recent growth, the cells immediately around the fungus will consist of round cells (granulation tissue); while, if the inflammatory process has been of longer duration, the central core of fungus may be surrounded by epithelioid and giant cells, outside which again is usually a zone in which the new connective tissue elements are maturing into a firm fibrous material. If the irritation is sufficiently intense, the inflammation goes on to suppuration, when the fungus lies detached in the abscess-cavity or is expelled with the pus; but this occurs by no means invariably.

The etiology of the disease is still obscure. The microörganism has never been recognized outside the body; and, apart from inoculation experiments, no direct relationship between the disease as occurring in the lower animals and as met with in man has been established. Israël is of opinion that both man and animals are probably infected from some common source, such as vegetables or water. Jensen (*Tidskrift f. Veterinaer*, xiii., 1883) traced an epidemic in Seeland to the eating of rye grown on land recently reclaimed from the sea; and Johne discovered a fungus closely resembling the actinomyces in grains of rye stuck in the tonsils of pigs. Israël is apparently inclined to hold that the malignant ray-fungus may under certain conditions develop from the harmless leptothrix found in the mouth.

There is strong evidence to associate the occurrence of the disease with the presence of carious teeth or dental fistulæ. In most of the recorded cases it is noted that the teeth were defective, and in several the malady originated at the site of decayed teeth or of a diseased portion of the jaw. In one instance reported by Israël (Congress of the German Sur-

gical Society, *British Medical Journal*, 1886, i. 797), where the lung was the seat of the growth, a piece of hollow tooth was discovered in the centre of the morbid area.

Attempts at cultivation of the microörganism have failed until the present year, when Prof. Boström, of Giessen, reports (*Jahresbericht über Path. Org.*, Baumgarten, 1886) that he has succeeded in making artificial cultivations of the fungus, which attain their maturity in five or six days, and present the typical appearance of actinomyces as occurring in man. He has not, however, produced the disease by inoculation of the growth thus obtained.

Inoculation experiments have been, to a certain extent, successful. Israël infected a rabbit by inoculation from man, and Ponfick produced the disease in calves by introducing portions of the tumor into the subcutaneous tissue, into the abdominal cavity, or into the veins.

The fungus may enter the body by one of three paths: the mouth and pharynx, the respiratory passages, and the digestive tract.

A. INVASION THROUGH THE MOUTH AND PHARYNX.—This occurs:

1. *From the lower jaw* (most frequently): the growth being connected with the jaw, or situated close to it, or in the submental or submaxillary region, or lower down in the neck. A remarkable feature in the history of actinomycosis is well illustrated in the case of growths occurring in the neck—that is, migration of the tumor. In one instance recorded by Israël, a tumor which in August was in the submaxillary region had by December reached the level of the thyroid cartilage. Not uncommonly the track of the growth may be recognized as an indurated band or cord extending from the jaw to the upper part of the tumor, and consisting of the cicatricial tissue resulting from the passage of the irritant, but in other cases there is no trace of its path. In yet other instances its course is marked by suppuration.

2. *From the upper jaw* (but seldom). Here the disease tends to affect the neighboring soft parts, to extend deeply into the adjacent tissues, and even to implicate the base of the skull and brain.

In typical cases the course of the malady in this region is slow and torpid, and for some time usually painless. The skin is not at first affected, but in many cases it is ultimately implicated; and when suppuration has occurred discharge will take place on the surface. In other cases the growth heals at one side by formation of cicatricial tissue with death of the fungus, while it extends at the other; and it is by this process that the tumor may shift its position in the manner described above. The prognosis is much more serious when the invasion is from the upper jaw rather than the lower, as there is a greater tendency to extension to deep structures. The only satisfactory treatment consists in the entire removal of the morbid tissue, and when the position of the growth is favorable a radical cure may be anticipated.

B. INVASION THROUGH THE RESPIRATORY TRACT:

1. *Localization on the bronchial mucous membrane* (bronchitis actinomycotica). A case is on record in which for seven years the patient suffered from general bronchitis without any evidence of implication of the lung-tissue proper or of impairment of the general health; the sputa throughout this period contained abundant actinomycotic granules. It is probable that in other instances this form passes into the next, where there is:

2. *Localization in the pulmonary parenchyma.* The course of this variety of the disease is divided by Israël into three stages:

a. When the lung only is affected. The microörganism sets up peribronchitis or pneumonia, the cells in the alveoli undergo fatty degeneration, and small yellowish-white tubercle-like masses are formed. Softening frequently occurs in the nodules, associated with suppuration, and not uncommonly with capillary hemorrhages; and thus cavities are formed in the tumor which may become continuous by the breaking down of the separating tissue. During this time a diffuse growth of connective tissue is taking place in the lung around these centres of disease, which leads to compression of the alveoli, and ultimately to the transformation of the affected portion into a dense mass of connective tissue rich in elastic fibres, separated from the cavities above described by a thin wall of granulation tissue in which the characteristic growth is embedded. The symptoms during this stage are commonly obscure. Usually the patient cannot assign any exact date to the commencement of his illness; the first indication of the pulmonary lesion is slight cough with scanty expectoration, which may attract no attention. Physical examination at this period may or may not determine the existence of the disease, according as the consolidation of lung is sufficiently extensive and superficial or the reverse. The contraction of the lung may be so marked as to cause falling-in of the chest wall. The posterior and lateral portions of the lung are most commonly affected, and hitherto no case has been met with in which the apices have been involved. The sputa may be mucopurulent throughout, or pneumonic in character, or slight hæmoptysis may occur, and the microscope may reveal the existence of the fungus.

b. When extension beyond the lung takes place. In this, the second stage, definite symptoms may first be recognized. Some degree of pleurisy is commonly induced. The direction usually taken is toward the surface, most often posteriorly and laterally, the prevertebral tissues being frequently attacked; or the disease may extend downward behind the diaphragm to the retroperitoneal tissues, and thence to the neighboring muscles. Or, secondly, the growth may pass through the diaphragm into the abdominal cavity; when diffuse peritonitis or a subphrenic abscess may result, or extension may take place directly into the liver

or the spleen; and in the latter case abscess in the organ attacked commonly results. Or, thirdly, the tumor may implicate the anterior mediastinum and the pericardium. As a rule, when the disease has extended beyond the lung, it spreads with increased rapidity. Definite symptoms are now present. Marked weakness usually exists, with an aspect of grave illness. Hectic, with profuse night sweats, commonly sets in; although the course of the temperature is by no means constant—being, in some cases, high, and in others low throughout. Irregular intercurrent rigors may occur.

c. When the skin has become implicated the third stage is reached. The superficial structures are generally attacked first, either over the chest or in the neighborhood of the dorsal or lumbar vertebræ; and the affection takes the form of a diffuse doughy infiltration, consisting of granulation tissue, which tends to spread widely. Ultimately the skin gives way, allowing the discharge of purulent fluid, or the débris of tissue, together with the characteristic fungus.

The duration of the disease, when it originates in the lung, is doubtful; from the commencement of definite symptoms it may last from five to twenty months; but it appears that a long period, probably from two to three years, may intervene between the attack on the lung and the death of the patient.

C. INVASION THROUGH THE DIGESTIVE TRACT:

1. *Localization on the surface of the mucous membrane.* In a case reported by Chiari the patient died with general marasmus after two years' illness; and the mucous membrane of the intestine was found to be almost universally covered with a white material, the mycelium of the fungus, occurring in patches raised in the centre and covered with yellow and brown granules, and closely adherent to the subjacent tissue.

2. *Localization in the substance of the intestinal wall,* with extension to neighboring parts. In this form, the actinomycotic tumors occur as small nodules seated in the mucous or submucous tissue. Softening tends to take place, leading to the formation of ulcers with undermined edges, the base of which may reach down to the muscular layer. Ultimately these ulcers may heal, leaving a simple scar. The conditions are more favorable to spontaneous cure in this form of the affection than in any other, as has been pointed out by Israël; the expulsion of the softened contents of the nodules is favored by the peristalsis of the intestine, and they are removed from the body by the ordinary action of the bowel; and thus a cicatrix may remain as the only evidence of previous actinomycotic infection. In most cases, however, the disease will spread to adjacent parts. The liver may be secondarily affected, usually through the portal system; but, in one instance, infection of this organ occurred from the vermiform appendix through an abscess-track in the retroperitoneal tissue.

As long as the intestinal tract only is affected there may be a total absence of symptoms, or the catarrh induced may have no characteristic features; and thus no suspicion of disease may arise until extension to other parts has occurred, when the symptoms induced will vary with the direction taken by the growth. Microscopic examination of the stools may reveal the presence of the fungus, and if the bladder has become affected the organism may be detected in the urine. Treatment in cases of the intestinal variety is necessarily in most cases palliative only, but in one instance Esmarch effected a cure by operation.

Whatever the primary seat of the disease, in any case of actinomycosis generalization of the growth by embolism may occur, and this not uncommonly after the tumor has long had a comparatively inactive local existence. The dissemination of the fungus will be accompanied by irregularly recurrent rigors and the usual symptoms of hectic.

The history of the following case illustrates the course of actinomycosis when the lung is primarily attacked, and presents certain features of special interest.

A. J. B., married, aged twenty-eight, was admitted into the Bristol General Hospital under the writer's care on October 31, 1885. He lived in Bristol, and was by occupation a house decorator.

In the family history the only facts worthy of note were that the patient's father died of consumption when fifty-four years of age, and that a brother was carried off by acute phthisis at the age of twenty-four.

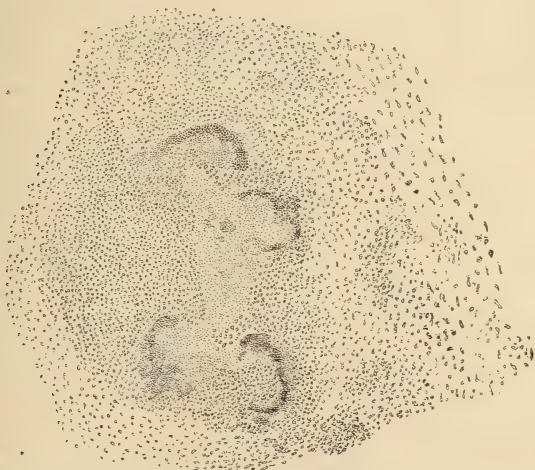
The patient had enjoyed good health up to Christmas, 1884, when he was confined to bed for three weeks with inflammation of the bowels. The house in which he lived was situated between a churchyard and an old burial ground, and its water supply was from a well. About three months before his admission the water, after heavy rain, became black and foul, and remained so for six weeks; he did not drink it while it was at its worst, but had done so for the last six weeks. There had been no other case of illness in the house. For the last three months the patient had been exposed to much worry and anxiety, and had not felt in his usual health; but about five or six weeks before admission he first definitely noticed that he was becoming listless and apathetic, and that his appetite was failing. About three weeks before admission he was suddenly seized under the right costal cartilages with a sharp pain on breathing, increased by lying upon either side, and this persisted until he came under observation. Of late, a sensation of fulness in the stomach had existed, but there had been at no time any sickness or diarrhoea, nor had rigors occurred. There had been marked loss of flesh and strength during the recent illness, and within the last fortnight profuse night sweats had set in.

On admission the patient was sharp-featured, pale, and thin, and presented the aspect commonly considered to be associated with a tubercular tendency. His chief complaint was of acute stabbing pain under the right lower costal cartilages, increased by deep breathing and by cough, as also by twisting the body. The respirations were 36 to the minute and shallow, and the pulse was 84 and rather weak. Physical examination of the lungs and the heart revealed nothing abnormal except

somewhat weak breathing over the right base posteriorly. The abdomen was rather distended, the liver dulness reached from the sixth rib to two inches below the margin of the thorax, and the organ was elastic, smooth, and rounded, and slightly prominent above, its anterior surface passing downward and somewhat backward to the free edge. Tenderness existed in the epigastrium and over the liver along the thoracic margin. The tongue was dry and furred, the teeth were decayed, and the breath was offensive. No other evidence of disease existed.

During the three weeks following admission the patient's chief trouble continued to be the pain and tenderness along the margin of the thorax. At the end of this time there was an appearance of fulness extending upward over the lower part of the right side of the thorax and downward over the liver, the lower intercostal spaces being partially obliterated. The free margin of the liver was now about three inches below the edge of the thorax. There was some degree of dulness, with weakened breath sounds and voice signs, over the right front, from the level of the fourth cartilage downward, continuous below with the liver-dulness; and over the right back dulness with weakened respiratory sounds, most marked from the base to the angle of the scapula, and becoming less definite upward to the scapular spine. The heart's apex was not appreciably displaced. Cough, with mucopurulent sputa, was now present. Loss of flesh was progressive, and profuse night-sweating continued. Reference to the chart shows that the temperature had been febrile throughout, and of a very irregular type—the lowest daily temperature varying from 98° to 100.2° , the highest from 100.4° to 103° , and the daily range varying from 0.8° to 4.3° . No rigors had occurred.

FIG. 1.



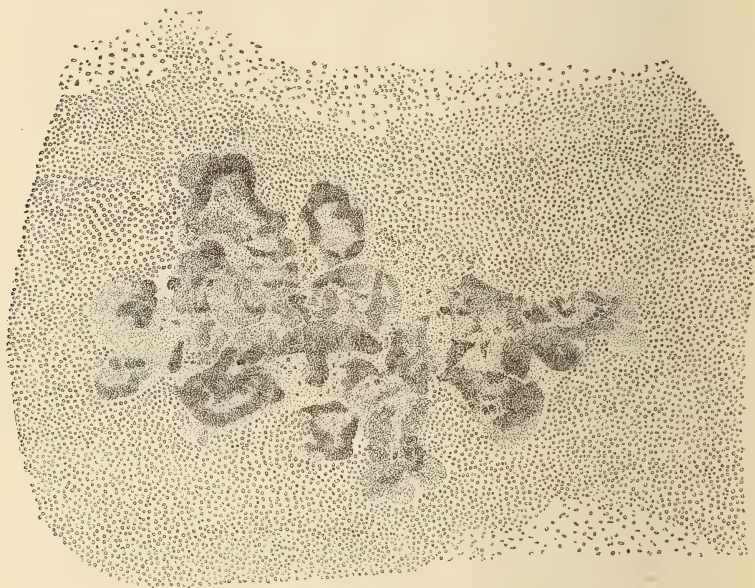
Each group lies surrounded by leucocytes, and these by connective tissue—more fine in Fig. 3.

An exploring needle was now introduced (November 18th) at various points over the area of thoracic dulness both in front and behind, and also into the liver; but with negative result.

By November 27th the heart's apex had become displaced outward

to the nipple line, and the dulness and diminution of breath-sound over the right side were more pronounced. Accordingly on that day an aspirator needle was inserted into the ninth interspace posteriorly, and a small amount of clear serous fluid was withdrawn. It was to be noted that during the whole of this period there was but little subjective sense of illness, the patient often expressing himself as feeling very well, except for the pain in the side.

FIG. 2.



Two groups $\times$ A Zeiss ($= \frac{3}{5}$ inch) to show general arrangement of larger groups. Fig. 3 shows well the gyrate mode of growth by decay of parts of circles and the intersection of others: cf. erythema gyratum, etc. In Fig. 4 the "rosetted" appearance of group is shown; in this it is seen that each segment of growing fungus is broader and more distinctly striated than in Fig. 3.

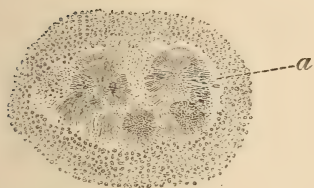
During the next month the chief change was in the lung symptoms and signs. Cough became much more frequent, and was accompanied by abundant mucopurulent expectoration, repeated microscopic examination of which gave a negative result. There was no evidence of increase of the pleuritic effusion, but high-pitched moist râles were more or less distinctly heard over the affected area. The night sweats and the hectic temperature continued.

On January 11, 1886, a loud rough diastolic murmur was detected, having its maximum over the fifth right costal cartilage about three inches from the middle line, and being well conducted over an area of about two inches, outside which it was quickly lost; and it could not be traced to the cardiac region. It was loudly audible at each examination for seven days, and it then abruptly disappeared.

During January marked improvement in the condition of the right side of the thorax took place. The upper limit of dulness fell to the

fifth cartilage, and over the whole area the absence of resonance became much less absolute, until, on January 18th, redux friction was first heard. At the same time the breath-sounds became clearer and the moist râles fewer. On the 21st and 22d of this month the sputa were colored with bright blood. From this time onward to the termination

FIG. 3.



A group $\times A$ Zeiss ($= \frac{3}{8}$ inch) shows probably the earliest stage of growth: each separate collection of fungus consisting of fine filaments radiating from a common centre.

FIG. 4.



The portion of fungus marked *a* in Fig. 3 $\times D$ Zeiss ($= \frac{1}{4}$ inch nearly). Under this power some of the filaments are apparently thicker than the majority, and are club-shaped.

of the case the thoracic condition ceased to form a prominent feature in the patient's state; the dulness became gradually less marked, but never completely disappeared at the base in front and behind; breath-sounds were audible with normal intensity, except over the area of persistent dulness, and the moist râles ultimately were but few. At the same time the cough became much less troublesome, and the sputa markedly lessened in amount.

On January 14th a new epoch in the clinical history was ushered in by a severe rigor, and from this time the phenomena were those of supuration with its accompanying systemic disturbance. Rigors followed on January 15th, 16th, 17th, 19th, and 29th, and on February 2d, 6th, and 9th. During this period there was no definite change in the physical signs, except that on February 12th the patient complained of very sharp pain over the region of the heart, and extensive pleuritic friction of cardiac rhythm was discovered. The colliquative sweatings continued; emaciation became extreme; and at length, after several days of apyrexia, the patient died from exhaustion on February 21st, sixteen weeks after admission.

There was at no time any vomiting, diarrhœa, or jaundice, and the results of exploratory puncture and of examination of the sputa were negative throughout. The treatment adopted does not call for special comment.

At the post-mortem examination it was found that the right lung was adherent to the chest wall, and that its base was firmly fixed to the diaphragm, as was the latter to the upper surface of the liver. The lower lobe of the lung adherent to the diaphragm was tough, firm, and airless; and on section it was seen to be transformed into a dense uniform mass of fibrous tissue, pale, glistening, and semi-translucent, and resembling in appearance the connective tissue infiltrations sometimes caused by syphilis. No trace of normal lung structure or of morbid growth was visible to the naked eye.

Opposite to its adhesions to the lung the diaphragm was, as above stated, closely bound down to the most prominent part of the upper and anterior aspect of the liver by dense fibrous tissue, which was dissected off with difficulty. It was then evident that there was a yellowish-white mass, about three inches in diameter, in the substance of the liver, coming to the surface where the adhesions to the diaphragm existed. When this tumor was cut into, it presented an appearance which is probably peculiar to actinomycosis. The growth measured about three and one-half inches antero-posteriorly, and about four and one-half inches vertically and transversely; it lay chiefly in the right lobe, but extended across so that its left end was seated in the left lobe of the liver. Its surface was bathed in pus, but in spite of its large size there was no sign of any definite abscess cavity, nor was the tissue at the centre broken down to any greater degree than that near the circumference. When the cut surface was washed the structure of the tumor became evident. A stroma of abundant fibrous tissue formed a felt-like or honeycombed mass, in the meshes of which were small loculi or spaces varying in size, some being scarcely visible to the naked eye, while others would contain a mustard seed or a pea. From many of

FIG. 5.



× D Zeiss (= $\frac{1}{7}$ inch nearly). The deeply stained portion is the more actively growing part of the fungus. It shows a more or less evident striation. At its edge is a fine filamentous network stretching into the adjacent mass of leucocytes. The central parts, lightly stained, and of a homogeneous or structureless appearance, indicate the dead tissue over which the ringed growth has already passed.

these spaces could be extracted the little spherical bodies before described as characteristic of actinomycosis. The tumor presented an irregularly lobulated outline, determined by the direction in which the growth was extending into the liver tissue around. Several separate centres of fungus existed as small patches in the substance of the liver in the neighborhood of the primary mass, and pus was visible in adjacent veins. In the lower lobe of the left lung near the anterior surface

was a secondary abscess, and over it an extensive patch of recent lymph. The other organs were healthy. No cause for the murmur which existed for a short time could be found; and it is probable that the sound was produced in a branch of the pulmonary artery involved in the change which was taking place in the lung tissue.

The microscopical structure of the tumor in the liver is well shown by the accompanying illustrations from elaborate and accurate drawings made for the writer by his friend and colleague, Dr. Michell Clarke, to whom he is also indebted for the original sections. It is evident that the fungus does not present a uniform aspect; and it appears that two distinct modes or stages of growth exist. In Fig. 2 the "rosetted" form usually described is seen, where the radiation of the threads from a common centre is evident, and the growing fungus is broad and distinctly striated; while in Fig. 1 the line of spreading fungus is narrower, the striation is less distinct, and the "fairy-ring-like" mode of growth is shown—indicative probably of the death of certain segments of the circumference of widened circles of fungus, and peripheral extension of the surviving portions. In Fig. 1 the dark narrow median zone of the growth takes the stain much more deeply than does the corresponding wider portion in Fig. 2. Each group is surrounded by leucocytes, outside which again is more mature connective tissue; and it is worthy of note that the fibrous tissue approaches much nearer the variety of growth represented in Fig. 1 than it does that exemplified in Fig. 2. It will be seen that epithelioid and giant cells are absent, as is usual in man. Within the ring of fungus is visible the débris of the tissue over which the growth has passed. It is probable that these differences in appearance are determined by the age of the fungus and the supply of nutritive material—that Fig. 2 represents an earlier stage, when there is abundant food for the microörganism; while Fig. 1, in which the individual filaments are dwarfed, illustrates the effect of the partial exhaustion of the nutritive material or the existence of a less congenial soil. This view is borne out by the relation of the connective tissue to the groups in the two cases; in Fig. 2 there is a wide zone of leucocytes and the formed connective tissue is still at a distance, while in Fig. 1 the leucocytes are much fewer and the maturing fibrous tissue more closely approaches the fungus—an indication of greater chronicity and, therefore, of less activity than has obtained in Fig. 2. When the microörganism dies out in the affected tissue, it is probable that this result is determined by an intensification of the conditions which are depicted in Fig. 1. Figs. 4 and 5 are high-power drawings of these two varieties of growth; in these it is seen that the fungus appears to consist of a network of filaments matted together in the middle of the advancing ridge, and spreading radially outward amongst the surrounding leucocytes. In Fig. 4 certain somewhat club-shaped bodies are apparently present; but out of a large number of sections these are visible in only two or three, and it is open to doubt whether the appearance may not be due to an accidental arrangement of the fine filaments which constitute the bulk of the growth.

It is remarkable that no trace of liver-tissue is visible in any of the sections. The first effect of the presence of the fungus in a part appears to be to cause aggregation of leucocytes, which destroy the preëxisting tissue; and it is in the granulation tissue thus formed that the organism spreads.

In the lung (Fig. 6) the affected portion is transformed into a mass of fibrous material, in which the remains of the pulmonary vesicles and their epithelial lining are here and there visible. Out of a large number of sections examined, the fungus exists in only one, and in this it is seemingly about to disappear before the connective tissue.

FIG. 6.



From lung. $\times$ Zeiss A. The section shows a portion of the affected lung—dense cicatricial fibrous tissue, with much elastic tissue, inclosing remains of alveoli in which the epithelium has proliferated. In this section the proportion of alveolar remains to fibrous tissue is unusually large.

The clinical history of the case recorded closely follows Israël's description of the course of actinomycosis originating in the lung. The patient was unable to assign any definite date to the outset of his illness; but doubtless during the three months of failing health the fungus had been growing in the lung, and the acute pain which led to his seeking advice ushered in the second stage of the disease—that of its extension beyond the pulmonary tissue to the pleura, and thence through the diaphragm to the upper surface of the liver. The irritation of the pleura resulted not only in the formation of dense adhesions at the base of the lung, but also in the effusion of serum above; and it is worthy of note that recovery from the pleurisy took place, the fluid becoming absorbed.

There is clear evidence that at one time the lung was much implicated in the disease. This is shown by the occurrence of pleurisy, the existence of abundant high-pitched râles indicative of pneumonic consolidation from irritation, and the accompanying cough, expectoration, and fever. As time went on, the fungus was expelled from the lung, and

the affected area became transformed into a mass of dense cicatricial fibrous tissue. This change was marked by gradual disappearance of the pleurisy and of the moist râles, and notable lessening of the cough and the amount of the sputa. During this time, however, the temperature (with its concomitant symptoms) was kept up by the continued invasion of the liver by the new growth. The occurrence of actual suppuration was indicated by the first rigor; the succeeding rigors marked the extension of suppuration to fresh areas of liver tissue; and the final rigor accompanied the secondary pleuro-pneumonia which attacked the left side shortly before death.

The case affords a striking illustration of the migration of an actinomycotic tumor. Just as a growth in the neck may, as before described, descend from the jaw to the thyroid cartilage, its track being marked by an indurated band of cicatricial tissue passing from the jaw to the migrated mass, so here did the tumor pass from the lung through the diaphragm to the liver, leaving as evidence of its path the cicatricial band of lung-tissue directly continuous with the liver by adhesions. Whether or not this process of removal from the lung was aided by the occurrence of suppuration and destruction of the pulmonary tissue, with expulsion of certain portions of the fungus by the bronchial tubes, is uncertain; but the clinical indications of suppuration did not occur until the improvement in the lung had taken place, and therefore, in all probability, were due to the liver rather than to the lung. There was no evidence post-mortem of the existence of the cavities, which, in other recorded cases, have been produced during the disintegration of the pulmonary tissue.

The duration of the disease after the occurrence of definite symptoms was sixteen weeks; and from the first indication of failing health twenty-eight weeks.

The diagnosis was a matter of difficulty. On the patient's admission typhoid fever, acute tuberculosis, and inflammation in the region of the lung and liver were discussed. Enteric fever was soon eliminated by the continued absence of its special symptoms, and the development of the signs of local mischief. It was much more difficult during the next period of the disease to exclude acute phthisis, inasmuch as the family history was in accordance with this theory, the general symptoms were such as are met with in this malady, and the local signs were not inconsistent with its existence. When, however, the thoracic condition underwent no marked improvement, and rigors nevertheless set in, it became evident that suppuration had occurred in the liver; and amongst the various possible determining causes of such an event, actinomycosis was suggested by the writer's friend, Dr. Michell Clarke. Failing the discovery of the fungus, however, the exact nature of the lesion could not be made out during life.

In a late stage, the treatment of actinomycosis of the lung is as hopeless as that of cancer under similar conditions; but if the diagnosis of the disease can be made before the extension of the growth from the lung to adjacent parts, and if the site of the lesion can be accurately determined by physical examination, it is possible that a radical cure may be effected by removal of the diseased tissue. For if excision of a portion of the lung is justifiable under any conditions, it is permissible in the case of a disease which appears to be so strictly localized at its outset, and which will so certainly ultimately spread more or less widely with fatal results. From the evidence at present available, however, it is most doubtful whether the growth can be detected and localized sufficiently early in its course to insure its complete extirpation; for when once the second stage—the stage of prominent symptoms—is reached, surgical interference can be of no avail.

Equally useless would be incision of the liver-abscess in such a case: for it is evident from the structure of the tumor that the pus cannot be drained from it, as was proved in a case recorded by Dr. Harley (*British Medical Journal*, 1885, ii. 1018); and a reference to the condition of the liver, as previously described, will demonstrate that, owing to the dissemination of the fungus through its tissue, nothing short of extirpation of the entire organ can insure the removal of the whole of the morbid growth.

IS THE "KNEE-KICK" A REFLEX ACT?

A RESEARCH MADE AT THE PHYSIOLOGICAL LABORATORY OF THE
COLLEGE OF PHYSICIANS AND SURGEONS, NEW YORK.

BY WARREN P. LOMBARD, M.D.

THE experiments here recorded were made in the Physiological Laboratory of the College of Physicians and Surgeons. I take this opportunity to express my thanks to Dr. John G. Curtis for his kind advice and assistance.

CHARACTER AND RESULTS OF THE EXPERIMENTS.

The object of the research described in this paper was to determine whether the time between the moment of the blow on the ligamentum patellæ and the beginning of the following contraction of the quadriceps muscle, is long enough to permit the phenomenon to be a reflex act. The result was the discovery that this period was only about one-fourth as long as that required for a skin reflex from the knee, and very little longer than that seen when the quadriceps muscle is incited to action by direct electrical stimulation.

CURRENT THEORIES.

Since 1875, when the attention of physicians was first called to the diagnostic importance of the phenomenon known as "knee phenomenon," "patella-tendon reflex," "knee-jerk," "knee-kick," "myotatic contraction," etc., there has been much thought given to the subject. The literature is already considerable. I have beside me over a hundred references, and there are undoubtedly many more. It would seem that there could be little new to say, but, in truth, all this work has not definitely determined the nature of the process, and it is not known to-day whether it is a reflex action or not.

There are two leading views concerning the matter; the one regards the contraction of the quadriceps muscle which follows a blow on the ligamentum patellæ as a reflex act, the other considers that it is due to mechanical stimulation of the muscle fibres. It has also been proved by experiments that the organ stimulated is, under normal conditions, not in the skin and not in the part of the tendon struck, but that it is situated at a distance, and is simulated by the sudden twitch and by the vibrations of the tendon, resulting from the blow. The nerve fibres which have been discovered in the tendon, near its attachment to the muscle, and in the sheath and the interstitial tissue of the muscle, as well as the muscle fibres themselves, are capable of being excited to action by mechanical stimuli, and they both seem to be in position to be affected by any sudden jerk or vibration of the tendon. Which of these organs is stimulated? If it be the afferent nerve fibres, the action is reflex; if it be the efferent nerve fibres or the muscle fibres, it is a local phenomenon. Both those who regard the knee-kick as a reflex act and those who consider it an entirely muscular operation admit that the integrity of the reflex arc is necessary to the phenomenon, for this has been proved by physiological experimentation as well as by clinical and pathological observations.

The chief argument in favor of the reflex idea is simply that the undoubted influence of the cord over the phenomenon can be satisfactorily explained in no other way. An explanation is given, however, by those who consider the process to be entirely muscular. They claim that the irritability of the muscle to mechanical stimuli is dependent on the tonus of the muscle, and that this condition is dependent on a continuous shower of weak reflex impulses from the cord. The loss of any part of the reflex arc is followed by a loss of muscle tonus, and, consequently, by a loss of the "knee-kick." The strength of this theory is somewhat impaired by the fact that we know little or nothing concerning muscle tonus, and that some observers state that it is not to be discovered by the most careful methods of experimentation.

The great argument advanced against the theory that the "knee-

kick" is a reflex act, is based on experiments which are thought to show that the time elapsing between the moment of the blow on the ligament and the beginning of the contraction of the quadriceps muscle is too short for a reflex action. Thus the majority of observers find the interval to vary between 0.030 second and 0.040 second, except under abnormal conditions, when, in lateral sclerosis, for example, it has been found as short as 0.016 second. Such intervals of time are compared with the presumable reflex time, and are found to be three times as short as they should be were the action a reflex process.

The reflex time for such an act as the "knee-kick" is, unfortunately, unknown and has to be calculated. Thus, it is said that the whole reflex time is the sum of: 1. The time required for the transmission of the nerve impulse through the afferent and efferent nerves (a distance of $1\frac{1}{2}$ metres at the rate of 30 metres a second), 0.045 second; 2. The time occupied by the reflex processes within the spinal cord (according to Exner's determinations from experiments on winking), 0.055 second; and, 3. The latent period of the muscle (determined on frog's muscle), 0.010 second. The whole reflex time is, therefore, said to equal about 0.110 second, while the interval between the blow and the contraction of the quadriceps equals only 0.030-0.040 second.

The champions of the reflex theory can scarcely doubt the accuracy of the experiments in which so many competent observers have gained the same results, but they answer that the time of such a reflex act as the "tendon reflex" may well be much more rapid than that which has been calculated. Thus, some observers have stated the rate of transmission of nerve force at 90 metres a second, instead of 30 metres, the assumed rate. The time Exner found for winking may not at all apply to processes in the lumbar cord. One has no right to judge the latent period of man's muscle from that of frog's muscle. In fact, there is no proof that the "tendon reflex" is not a very rapid reflex act.

And thus the question is left undecided, neither party being able to advance any absolutely conclusive argument.

EXPERIMENTS BY THE AUTHOR.

Study of the work already done on this subject led me to think that it was quite possible that the contraction of the quadriceps muscle following a blow on the ligamentum patellæ was a compound act; that both sensory nerve fibres and muscular fibres were stimulated by the twitch; and that the contraction was due, first, to direct mechanical stimulation of the muscle fibres, and, second, to reflex nerve impulses. This might well be the case, and yet the two movements might be so fused together that the unaided eye would be unable to distinguish them. The idea naturally suggested itself, that, by the graphic method, one might get a curve which would reveal the influence of two separate im-

pulses. Moreover, one could measure the intervals of time elapsing between the moment that the blow was struck and the instant that each of the waves of contraction, resulting from the two impulses, should begin to show itself, and could compare these intervals with the period elapsing before the contraction of the muscle when it was stimulated directly by an induction current, or, reflexly, by an impulse coming from the skin near the knee. If when the ligamentum patellæ was struck, two oscillations of the curve of contraction should be seen, and two intervals should be obtained which corresponded, the one, with those got when the muscle was stimulated by electricity, and the other, with those got when the muscle was stimulated by reflex impulses, the cause of the contraction would be evident. If, on the other hand, no second interval should be seen, it would be no proof that the act was a simple one; but the time elapsing before the beginning of the contraction might be found to correspond to one or the other of these periods, and at least the true nature of the beginning of the phenomenon might thus be disclosed.

Accordingly, a number of experiments were made, in which the moment when the stimulus was applied and the moment when the quadriceps muscle had contracted sufficiently to move the foot were accurately recorded. The stimulus was applied in three different ways, viz.: 1. Directly to the muscle, by an induction current sent into it through the skin; 2. Indirectly, by a blow on the ligamentum patellæ; and, 3. Reflexly, by means of irritants employed on the skin near the knee. A study of the form of the curves and of the intervals of time thus obtained gave the following results.

Under normal conditions, when the ligamentum patellæ is struck, the curve of the resulting contraction of the quadriceps muscle shows an unbroken rise, followed by an equally regular fall, and presents no peculiarity which would suggest that the muscle had received more than one stimulation.

The shortest interval between the moment of stimulation and the beginning of the contraction, as registered by the movement of the foot, is seen when the muscle is stimulated directly by the induction current; the next shortest, when it is stimulated by a blow on the ligamentum patellæ; and the longest, when it is stimulated by a reflex impulse coming from the skin near the knee. The time determinations of these intervals were gained in each case by the same apparatus, and can, therefore, be safely compared.

The following table shows the percentage in which an interval of any given length occurred in the experiments of each day, and in the total number of experiments, made with each of the three methods of stimulation. Under Series I. are grouped all that series of experiments in which the rectus was stimulated directly by electricity; under Series II. are grouped those experiments in which the stimulus was a blow on the

ligamentum patellæ; and under Series III. are grouped those experiments in which the muscle was stimulated by a reflex impulse from the skin near the knee. The experiments of different days are placed in separate columns, and the letter beneath the date represents the name of the man experimented on. At the left hand of the table, beneath the word seconds, is a column of the intervals seen to elapse between the moment the stimulant was applied and the moment the foot began to be moved by the contracting quadriceps muscle. On the same line with each interval is seen the percentage of the experiments of each day in which that interval occurred; and at the right hand of the table, under I., II., III., stand the percentages of all the experiments having this interval by each of the three methods.

At the bottom of the table are two lines of figures arranged by series and dates. The upper line gives the number of experiments made on each day by each method of irritation, and also the total number of experiments made with each method of irritation. The lower line gives the average length of the intervals obtained from these experiments.

A glance at this table shows a great similarity in the length of the intervals in the experiments of Series I. and Series II., whilst the intervals of the experiments of Series III. are all very much longer than these. A comparison of the lengths of the average intervals got from experiments in Series I. and II.—*i. e.*, from experiments in which the muscle was stimulated by the direct application of electricity, and those in which it was stimulated by a blow on the ligamentum patellæ—reveals a difference of only 0.007 second. This similarity suggests a similarity in the phenomena. Comparison of these average intervals with the average interval of experiments in Series III.—that is, those in which the muscle was stimulated by a reflex impulse from the skin—discloses the fact that the average interval for experiments in Series III. is three to four times as long as the average intervals of experiments in Series I. and II.

How far may these average intervals be trusted for purposes of comparison? In all experiments marked variations in the length of the intervals were seen. They were least when the muscle was stimulated by electricity, more when the stimulant was a blow on the ligamentum patellæ, and by far the greatest when the stimulus was of reflex origin.

When the muscle was excited to contraction by direct electric stimulation, the average length of the intervals obtained from the experiments of each day was between 0.060 second and 0.070 second; the length of the average interval got from all the experiments was 0.064 second; and 47.5 per cent. of all the experiments had intervals ranging between 0.060 second and 0.070 second. Outside of these limits the variations were as follows: 29.4 per cent. had shorter, and 23 per cent. had longer intervals. These figures make it evident that 0.064 second is a just average interval.

TABLE OF PERCENTAGES, ETC., JANUARY AND FEBRUARY, 1886.

SECONDS.	SERIES I.					SERIES II.							SERIES III.				TOTAL.				
	Feb. 5.	Feb. 8.	Feb. 9.	Feb. 23.	Feb. 25.	Jan. 21.	Jan. 26.	Feb. 5.	Feb. 6.	Feb. 8.	Feb. 9.	Feb. 23.	Feb. 25.	Jan. 26.	Feb. 8.	Feb. 9.	Feb. 23.	Feb. 25.	I.	II.	III.
	A.	B.	C.	D.	D.	A.	B.	A.	D.	B.	C.	D.	D.	B.	B.	C.	D.	D.	A, B, C, and D.	A, B, C, and D.	B, C, and D.
0.03-0.04	...	...	9	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	1.6	0.9	
0.04-0.05	...	6	...	...	...	29	9	...	...	11	9	...	43	...	...	...	...	...	1.6	12.3	
0.05-0.06	20	40	27	30	13	71	9	60	...	...	4	...	36	...	...	...	...	...	26.2	17.5	
0.06-0.07	40	20	46	50	80	...	9	20	...	11	18	7	7	...	...	...	...	...	47.5	8.8	
0.07-0.08	30	20	9	20	7	...	55	20	63	33	23	39	...	...	...	...	...	...	16.5	28.1	
0.08-0.09	10	7	9	...	...	...	9	...	37	23	27	35	7	...	...	...	...	...	4.9	20.9	
0.09-0.10	...	...	...	...	...	...	...	...	...	...	...	16	...	...	...	...	...	...	...	5.3	
0.10-0.15	...	7	...	...	...	...	9	...	...	11	14	3	...	...	8	...	...	...	1.6	5.3	2.1
0.15-0.20	...	...	...	...	...	...	...	...	...	11	...	...	...	16	25	...	...	8	...	0.9	10.4
0.20-0.25	...	...	...	...	...	...	...	...	...	...	...	...	...	17	42	34	34	75	...	...	43.7
0.25-0.30	...	...	...	...	...	...	...	...	...	...	...	...	...	17	...	33	33	17	...	...	18.7
0.30-0.35	...	...	...	...	...	...	...	...	...	...	...	...	...	50	17	33	33	...	...	...	22.9
0.35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	2.1
No. of experiments	10	15	11	10	15	14	11	5	8	9	22	31	14	6	12	9	9	12	61	114	48
Average interval	0.068	0.067	0.061	0.063	0.063	0.052	0.075	0.060	0.079	0.090	0.077	0.082	0.051	0.271	0.232	0.268	0.270	0.226	0.064	0.071	0.253

When the muscle was stimulated by a blow delivered on the ligamentum patellæ, the average length of the intervals obtained from the experiments of each day varied from 0.050–0.090 second; the length of the average interval got from all the experiments was 0.071 second; and 36.9 per cent. of all the experiments had intervals ranging from 0.060–0.080 second; 30.7 per cent. had shorter, and 32.4 per cent. had longer intervals. Thus, though one must remember that the intervals varied widely, one can fairly state the average interval at 0.071 second.

Similarly, it may be said that the average interval obtained from experiments in Series III. may fairly be accepted for purposes of comparison.

Before any conclusion as to the similarity or dissimilarity of these phenomena can be based on a comparison of their average intervals, one must ascertain upon what the differences in the average intervals depend. An analysis of the interval recorded as elapsing between the moment that the stimulus was applied and the moment the foot began to move in response to the contraction of the quadriceps muscle, shows that it is made up of the following periods, viz.:

1. The time occupied by all the processes occurring between the moment the stimulant is applied and the moment the stimulus reaches the muscle. This period would vary with each form of stimulant, and would depend on the length and the nature of the path which the stimulus had to travel.

2. The time required for the muscle to respond to the stimulus. The latest observations state the latent period of the normal frog's muscle at about 0.003 second. We do not know the latent period of man's muscle. It would, without doubt, vary with the irritability of the muscle. As in these experiments the subjects were normal and were placed under the same conditions, the latent period of the muscle can be regarded the same in all the experiments.

3. The time required for the muscle to contract enough to move the foot. This would depend on—

- a.* The tension of the muscle at the time it was irritated. This was very slight and was apparently the same in all the experiments.

- b.* The amount the contracting muscle was stretched by the resistance of the leg, etc. This was the same in all experiments.

- c.* The time required for the contracting muscle to overcome the inertia of the limb and of the recording apparatus. This would be, probably, about the same as the time required to register the jar of the blow. This period was determined by fifty experiments to be about 0.013 second. It was about the same in all experiments.

- d.* The number of muscle fibres irritated, which would vary with the nature of the stimulant, its strength, and the method of its application.

- e.* The strength of the stimulus.

4. All the intervals recorded are 0.003 second too short, for this amount of time was lost by the electro-magnet in recording the moment of the blow.

The periods numbered 2, 4, and *a*, *b*, and *c*, under 3, were the same for all forms of experiments and need not be further considered. Any differences seen between the average intervals obtained by the three different methods of experimentation were dependent on differences in the length and nature of the paths which the stimulus had to travel; on differences in the number of muscle fibres stimulated, due to differences in the nature, strength, and method of application of the stimulant; and on differences in the strength of the stimulus.

How far would those causes which determine the activity of the contraction of the muscle affect the result? In the case of experiments in which the muscle was stimulated by electricity, the electrodes were only six inches apart, and, therefore, comparatively few muscle fibres were directly stimulated; the stimulus may have spread to many others, however, by means of the nerves which were excited. The stimulant employed was of medium strength, an induction current being chosen which just sufficed to cause an undoubted movement of the foot. These facts would lead one to surmise that a comparatively long time elapsed between the moment that the stimulus reached the muscle and the moment the foot began to move in response to its contraction.

In the case of experiments in which the muscle was stimulated by the results of a blow on the ligamentum patellæ, if the stimulation was reflex, all the muscle fibres must have been stimulated in each experiment; if the stimulation was effected by direct excitation of the muscle fibres, the number of fibres stimulated must have varied with the tension of the muscle, the force of the blow, and the place struck. The strength of the stimulus, though undoubtedly very variable, was, to judge from the extent of the movement of the foot, in most experiments, considerable. These facts lead one to believe that a comparatively short time elapsed between the moment that the stimulus reached the muscle and the moment the foot began to move in response to its contraction.

There is no way of accurately determining how many muscle fibres were stimulated by either method of experimentation, or what was the relative strength of the stimulants employed. The above facts, however, would lead one to infer that the contraction of the muscle would have been comparatively slow in experiments in which the muscle was stimulated by electricity, and, so far as this influence could have determined the result, that the average interval would have been somewhat longer in these experiments than in those in which the muscle was stimulated by the results of a blow on the ligamentum patellæ. In reality, however, the reverse was true, and the average interval of experiments in Series I. was 0.007 second shorter than that of experiments in Series II. This

result can be due only to the other factor which goes to determine the length of the intervals—that is, the length and nature of the paths which the stimulus had to travel in the two cases. The stimulus has, then, to pass by a longer path in the case of experiments in which the ligamentum patellæ is struck than in the case of those in which the quadriceps is stimulated by electricity; and this difference in the length and nature of the paths is enough to make the average interval of the experiments of Series II. not only as long, but 0.007 second longer than that of the experiments of Series I. As has been said, there is no way of determining what effect the possible difference in the number of muscle fibres stimulated by the two methods of experimentation, and the possible difference in the strength of the stimulant employed in the two cases, may have had on the average intervals; one can only conclude that the difference in the length and nature of the paths travelled in the two cases is somewhat more than is represented by 0.007 second.

What are the paths which the stimulus would have to pass over when the two methods of stimulation under consideration are employed? In the case of electric stimulation the electricity would only have to pass from the wet electrode, through the moist skin, the subcutaneous tissue, and the fascia to reach the muscle. In the case of a blow on the ligamentum patellæ, if the muscle fibres were stimulated mechanically, the jerk and the vibrations of the ligament would have to be transmitted along the chain of ligament, patella, quadriceps tendon, and quadriceps muscle. If the muscle were stimulated reflexly, the stimulus would have to pass, in addition to the above, through the afferent nerves to the spinal cord, through the reflex mechanisms in the cord, and through the efferent nerves to the muscle. There can be little doubt by which path the stimulus would soonest reach the muscle. The muscle would be stimulated soonest by electricity, almost as soon by the mechanical stimulation of a sudden jerk transmitted to it from the tendon, and some time later by reflex stimulation.

The difference between the periods of time required for the stimulus to pass from the point to which the stimulant was applied, to the muscle, in the experiments of Series I. and II, is, as has been stated, somewhat more than 0.007 second. Were the stimulation reflex in character, we should expect a very marked difference. The reflex time for such a process as the "knee-kick" has been supposed to be, cannot be calculated, because the rapidity of different reflex processes probably varies greatly; we may, however, obtain a rough idea of its length. It is the sum of the following periods, viz.:

1. The time required for the transmission of jerk and vibration, resulting from the blow, from the ligament to the sensory nerve ends in the tendon or muscle, and the time spent by them in awakening to activity. This period cannot be determined.

2. The time required for the transmission of the stimulus through the afferent nerves to the cord, and from the cord through the efferent nerves to the muscles. At the quickest estimated rate of transmission of nerve force, 90 metres a second, 0.016 second would be required for the passage of the impulse through a metre and a half of nerve length. Exner, in his calculations, uses the rate of 62 metres a second; at this rate 0.024 second would be required. By the more usual estimate, of 30 metres a second, nearly 0.050 second would be required for the transmission of the impulse to and from the cord.

3. The time occupied by reflex processes within the cord is probably very variable. Exner found it, in his determinations on winking, to equal 0.055 second.

4. The latent period of the muscle.

It is not worth while to add these periods together, for the result would give no accurate idea of the reflex time. The only use of referring to them is to show that, so far as we can judge from present knowledge, even rapid reflex processes require considerable time. Here it is interesting to compare the average intervals got by the experiments of Series I. and II. with the average interval of experiments of Series III., in which the stimulus was a reflex impulse called out by a vigorous electric irritation of the skin near the knee. The average interval of the experiments in Series I. is 0.064 second, that of the experiments in Series II. is 0.071 second, and that of the experiments in Series III. is 0.253 second—*i. e.*, the average interval of the experiments in which the muscle was stimulated by a reflex impulse from the skin near the knee is three or four times as long as that of the experiments in which the muscle was stimulated by electricity, or by a blow on the ligamentum patellæ. The fact that a portion of the reflex interval was occupied by a summation of the impulses produced by the induction shocks, makes little difference, for, as the current was quite strong, and the hammer of the induction apparatus was vibrating very rapidly, the summation would have occupied but little time.

It may well be said that a reflex process, such as the "tendon reflex" is supposed to be, might be very much shorter than that of a skin reflex from the knee. This is true, but that it might be so much shorter as to require but little more time than the direct electric stimulation of the quadriceps is not at all evident. On the other hand, the difference found between the average intervals of experiments in Series I. and II. is about what one would expect to find were the muscular fibres of the quadriceps stimulated mechanically by the jerk and vibrations which would result from the blow on the ligamentum patellæ.

There is one more point to which it is necessary to refer. Not only do the experiments in Series II. have intervals closely resembling those of the experiments in Series I., but a larger percentage of the experiments

of Series II. have very short intervals than of the experiments in Series I. Thus, 12.3 per cent. of the experiments in Series II. had intervals ranging from 0.040–0.050 second, while only 3.2 per cent. of the experiments of Series I. had intervals as short. These very short intervals of Series II. are hard to reconcile with the idea that the stimulus had to pass through the cord before it reached the quadriceps muscle, but they might well have occurred had a vigorous blow on the ligament thrown all the muscle fibres into vibration.

The results of my experiments do not settle the question in dispute, but they add weight to the opinion already expressed by many competent observers, that the "knee-kick" is not a reflex act. Moreover, the mechanical conditions on which the "knee phenomenon" depends, the fact that muscle fibres are stimulated if they are suddenly twitched, and that the fibres of the quadriceps are in a position to be thus stimulated, and the time found to elapse between the blow on the ligamentum patellæ and the contraction of the quadriceps, all go to suggest that the phenomenon is entirely peripheral.

Although, as a rule, the contraction of the quadriceps which follows a blow on the ligamentum patellæ is a simple act, there was one set of experiments, among those recorded, which seemed to be an exception. Many of the curves got from one man, and on one day, showed an irregularity such as one might expect, if, when the original contraction of the muscle had reached its highest point, or when the muscle had even begun to relax, a second impulse had reached it, and caused it to contract still further. What was most interesting in this change in the form of the curve was that it occurred at an interval after the blow which closely corresponded to the interval got when the muscle was stimulated by a reflex stimulus coming from the skin near the knee. It suggested, of course, that the muscle received two impulses, as a result of the blow on the ligamentum patellæ, the one, a direct mechanical stimulation, the other, a reflex stimulus. The curve was never carried by the second oscillation to any marked height, however, and the chief part, as well as the first part of the "knee-kick," under normal conditions, at least, would seem not to be due to reflex stimulation. The rest of the curves obtained from the same man, on other days, and from the other men experimented upon, were searched in vain for any wave which might suggest the action of two separate impulses. The fact that such an oscillation of the curve was noticed is the more interesting because I have heard that de Watteville claims that the "knee-kick" is always a compound act.

As the results here given are of importance, and are liable to be questioned, it seems desirable that a more detailed account of the experiments and of the methods pursued should be given. I therefore state them here for those readers who are more especially interested in this subject.

REQUIREMENTS OF THE RESEARCH.

The experiments must be made on man.

The subject must be placed at rest, in an absolutely comfortable position, in order that there shall be no disturbing movements or unwished-for reinforcements.¹

The thigh must be steadied by a form of support, which, while it prevents movement being caused by the jar of the blow, when the ligamentum patellæ is struck, does not press on the quadriceps muscle, or on the large vessels or nerves.

The leg must be entirely free to move in response to the contraction of the quadriceps, and the weight of the leg and foot must be as far as possible gotten rid of, in order that the muscle may not be stretched, and the beginning of the contraction be lost. The contraction, rather than the swelling of the muscle, must be recorded, because it is the more marked event, and more likely to reveal the character of the action.

The recording apparatus must consist of a rapidly moving surface, and of three writing points: one attached to a tuning-fork to record the rate at which the surface is moving; another, connected with an electro-magnet, to mark the moment the irritation is given; and a third, to write the contraction of the muscle.

In accordance with these requirements, the following apparatus was put together.

DESCRIPTION OF THE APPARATUS USED IN THE EXPERIMENTS.

The man experimented upon lay on his left side on a comfortable couch, so formed as to support the head and back. The right thigh rested on a prop of plaster, shaped so as to conform to the inner and posterior surface of the thigh, and of such a height as to hold the knee on a level with the hip-joint. The right foot was supported by a swing suspended by a cord from the ceiling.

The movement of the foot, in response to the contraction of the quadriceps, was recorded as follows: A strong inelastic thread, attached by one end to the swing on which the foot was fastened, was guided by two accurately working pulleys to the top of the recording needle. One of these pulleys was on a movable stand, having a heavy base, and its position could be changed to correspond to the position of the foot, and thus the direction and the tension of the thread could be regulated. The other pulley held a fixed position, and the thread passing over it suspended the writing mechanism. This mechanism was cross-shaped, and consisted of a vertical shaft bearing a horizontal needle, which was adjustable at any desired height on the shaft. The vertical shaft was suspended from the end of the thread beneath the second pulley, and

¹ Mitchell, *The Medical News*, February 13 and 20, 1886.

was insured free vertical movement and freedom from lateral oscillations by passing through two smoothly bored holes in two thin strips of metal, which were supported about fifteen centimetres apart by an iron standard. One end of the horizontal needle terminated in a fine rounded point, and rested against the blackened drum of a Ludwig kymographion (Baltzer's manufacture). Constant contact with the drum was secured by a fine plumb line, which hung against the other end of the needle. Contraction of the quadriceps and extension of the knee caused the needle to rise, while relaxation of the muscle and flexion of the knee were recorded by a fall of the curve. It was desired to detect any irregularity in the contraction of the quadriceps, and, therefore, it was especially necessary to prevent the needle from being thrown by the sudden jerk of the kick beyond the height which corresponded to the absolute movement of the foot. A thin yielding band of rubber was therefore attached to the lower end of the vertical shaft and to the floor.

The kymographion ran with great regularity, but this was not relied upon, and the rate of rotation was measured during each experiment by a tuning-fork, which, by means of a light metal point attached to one of the arms, wrote its vibrations on the drum.

An electro-magnet recorded, by a light lever attached to its armature, the moment the blow was struck on the ligamentum patellæ, or the moment that the induction current was thrown into the quadriceps muscle or the skin. The pattern of the magnet resembles that of Pfeil, of Berlin (described by Tigerstedt, *Arch. für Phys.*, Supplement Band, 1885), and its latent period was a little less than 0.003 second.

The instruments used for irritating were as follows:

The blow on the ligamentum patellæ was given by a medium-sized steel hammer, one end of the head of which was tapered to a dull edge, about an inch long and covered with a rounded rubber cap, of the thickness of a lead pencil. In cases in which the "knee-kick" was well marked, the ordinary percussion hammer was sufficient. The electric circuit of the recording electro-magnet was closed when a strip of platinum foil on the rubber end of the hammer touched a piece of gold braid, which was fastened by a garter over the ligamentum patellæ.

The induction current was applied to the rectus muscle by two wet electrodes, placed on the skin over the middle third of the muscle and about six inches apart. When it was necessary to stimulate the cutaneous nerves, the induction current was applied by a wire brush and a platinum point about half an inch apart.

In the case of electrical stimulation, one key simultaneously closed two circuits; the one going through the muscle, or the skin, the other through the electro-magnet.

A Grove cell was used for the electro-magnet, and another for the Du Bois-Reymond induction coil.

The same magnet recorded the moment of stimulation, and the same apparatus wrote the beginning of the contraction of the quadriceps, whatever the means of stimulation employed—*i. e.*, whether the muscle was stimulated by a blow on the ligamentum patellæ, by the direct application of the induction current, or by the reflex impulse resulting from the irritation of the skin near the knee. Therefore, the latent period for the apparatus was the same in all the experiments, and any difference in time which was found, was due to variations occurring between the moment the stimulant was applied and the moment the stimulated muscle had contracted enough to move the foot; in other words, to differences in the length and nature of the paths which the stimulus had to travel, and in the activity of the muscular contraction.

To conclude—from the experiments recorded in this paper, it would seem that the contraction of the quadriceps muscle following a blow on the ligamentum patellæ comes much too soon to be the result of a reflex stimulation. It is probable that the stimulation is due to a sudden stretching of the muscle fibres, and that the stimulus has the same character as when the muscle receives a direct blow. Before this conclusion can be accepted, however, the undoubted influence of the spinal cord upon the production of the phenomena must be explained. The current explanation that the irritability of the muscle to finer mechanical stimuli is dependent on “muscle tonus,” will not be altogether satisfactory until the existence of “muscle tonus” is proved.

It seems probable, that, in addition to the first impulse which comes to the quadriceps when the ligamentum patellæ is struck, occasionally a second impulse, of reflex nature, originating either in the nerve ends of the skin or of the tendon and muscle, may come to it and increase the height of the contraction. Under normal conditions, however, this would seem to play a very subordinate part.

BACTERIOLOGY.

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(THIRD PAPER.)

RELATION OF BACTERIA TO THE LIVING ANIMAL BODY.

FROM this brief summary of the relation of the bacteria to the soil in which they grow some idea will be obtained of the very important place which they occupy in the economy of nature. Without these

lowly organisms the highly organized animal and vegetable tissues would remain without undergoing decomposition, and, not being assimilable by plants, a large and constantly increasing amount of food for plants and consequently for animals would thus be withdrawn from circulation, with the result that ultimately vegetable animal life must cease for want of food. Such a catastrophe is provided against by the action of these minute plants. They can, as we have seen, assimilate these highly organized substances, converting part of them into their own protoplasm, but breaking up the greater part into lower compounds, and the successive action of different species gradually reduces them to the simplest forms—carbonic acid, water, ammonia, nitrites, and nitrates—which are easily assimilable by the higher plants and go to build up again compounds suitable as food for animals. Less important than this complete reduction of organic substances, but still of great value, are the partial decompositions of the class of fermentations. For by means of these fermentative processes substances are produced which are of great use as articles of food and in the arts. But these are not the only influences which the bacteria exert in nature. Another and more important point, from a medical point of view, is their relation to living animals. The researches of Panum and others, have established the fact that among the numerous products of the growth of bacteria are some which act as poisons on animals and vegetables, and Brieger has succeeded in several instances in isolating these poisons (which belong to the class of alkaloid substances) and in studying their chemical constitution, their origin, and their action on the living body. The existence of poisonous products was also shown by Koch, in his work on *Wundinfektionskrankheiten*. He found that when a considerable quantity (five drops) of a putrid liquid was injected into mice the animals often died very quickly, symptoms of poisoning setting in immediately after the injection. The absence of bacteria from the blood and organs, the innocuous character of the blood (injections of blood from such an animal did not produce symptoms of poisoning), and the rapid onset of symptoms and speedy death showed that these animals had died from a chemical poison contained in the putrid material injected. These facts, obtained as the result of experiments on animals, correspond with and clear up several facts observed in man. It has been long observed that, after large operations, such as amputation at the hip-joint, a patient may apparently be doing well for a day or two, when suddenly serious symptoms set in, the patient becomes collapsed and dies in a few hours of what has been termed by some authors “secondary shock.” In these cases it will be found that the discharges in the wound have undergone decomposition (putrefaction), and there can be no doubt from a consideration of all the facts, experimental and otherwise, that the patient has died from the absorption of the poisonous substances formed in these putre-

fyng discharges. The simple fact that, where care is taken by antiseptic means to prevent the growth of bacteria in the discharges, these symptoms do not occur, proves this point. Cases of this kind are now grouped under the head of septic intoxication. This subject of septic intoxication will be referred to presently.

The production by bacteria of chemical poisons capable of destroying animal life naturally leads to the discussion of the relations which exist between bacteria and the living animal tissues and to the inquiry into the consequences of introducing bacteria into animals. The investigation of this matter brings out at once the fact that just as different species of bacteria act differently on the dead soil on which they grow, so different forms behave differently in relation to the living body, and, from this point of view, bacteria may be roughly divided into two classes: those which are able to live in the blood or tissues of living animals (parasitic bacteria) and those which are unable to grow under similar conditions (non-parasitic bacteria). Of known bacteria the great majority are non-parasitic on animals, at any rate on mammals.

The fate of non-parasitic bacteria when they gain admission to the blood and tissues of living animals has been investigated by various authors. Traube and Gscheidlen came to the conclusion, as the result of their experiments, that the living blood and tissues have the power of destroying microorganisms. In some experiments on microorganisms in wounds treated aseptically,¹ I came to a similar conclusion with regard to healthy animals. Into the veins of medium-sized rabbits, varying quantities of a putrefying infusion containing bacteria were injected. The animals were killed after twenty-four hours and their organs, or portions of them, introduced with suitable precautions into vessels containing cultivating infusions. These vessels were placed at the temperature of the body and watched for the development of bacteria. If from one-fourth to three-fourths of a cubic centimetre were injected, as a rule, no organisms developed. But if one cubic centimetre or more was used, bacteria were found alive after twenty-four hours. I explained this by supposing that in the latter instance a sufficient quantity of the poisonous products of the bacteria had been injected along with the organisms to depress the vitality of the animal and thus reduce the activity of the destructive process, for I found in another series of experiments that if the animal was in a bad state of health this rapid destruction of bacteria in the body did not occur. More recent researches have shown the probability of this view. I did not at the time attempt to show where the bacteria were destroyed or how they

¹ Antiseptic Surgery, Its Principles, Practice, History, and Results, p. 252.

were got rid of, but in a subsequent research¹ I came across facts which seemed to suggest that the kidney is an active agent in the excretion and destruction of certain bacteria. After injecting a special kind of micrococci into the veins of rabbits, I found that they were present after death in masses in the kidney tubules, although I could nowhere detect any rupture of vessels in the glomeruli or elsewhere, nor any plugs in the bloodvessels. That, however, this view does not hold good for many other kinds of bacteria will be seen from the research to which I must now allude.

Wyssokowitsch,² under the direction of Prof. Flügge, has gone into this matter very fully. His method was to mix a pure cultivation of the bacteria to be tested with sterilized distilled water, and then by means of further dilution and plate cultivation, to estimate the numbers present in a cubic centimetre of the original mixture. As a rule, the fluids injected contained 20 to 40 million bacteria per cubic centimetre. A definite quantity of these fluids was injected into the aural veins of animals (chiefly rabbits), and at various intervals of time specimens of blood were taken with precautions against contamination and examined for microorganisms by means of the microscope and by cultivations, or the animals were killed and portions of their internal organs were examined in a similar manner. A large variety of bacteria were tested in this way.

Wyssokowitsch found that very soon after injection there was a partial or complete disappearance of microorganisms from the blood. The saprophytic or non-parasitic bacteria disappear most quickly, none being present in the circulating blood after three hours at most, even though enormous numbers were injected. And even if the bacteria employed are pathogenic for the animals experimented on, as, for instance, anthrax for rabbits, they diminish in numbers very rapidly, and may even for a time apparently completely disappear, especially if the numbers introduced be comparatively few; after a variable time, however, they reappear and gradually increase in numbers till death occurs.

The next question which Wyssokowitsch studied was, What becomes of the bacteria? Are they excreted by any organ, or are they destroyed in the blood? He has been unable to find any evidence of excretion of living bacteria. He tested urine, milk, and intestinal juice without finding the bacteria in them, unless some lesion of the walls of the vessels, as in the glomeruli, had occurred, allowing hemorrhage to take place. As to their destruction in the blood, he observed constantly an increase in the number of white corpuscles after the injection, but

¹ On Micrococci in relation to Wounds, Abscesses, and Septic Processes. *British Medical Journal*, September and October, 1884.

² Ueber die Schicksale der ins Blut injicirten Mikroorganismen im Körper der Warmblüter. *Zeitschrift für Hygiene*, Bd. I. Heft 1.

this was apparently insufficient to account for the phenomena. He, therefore, had to ascertain whether the rapid disappearance of the bacteria from the blood was to be accounted for on the supposition that they are deposited in certain organs, as occurs in the case of pigment. To test this, he killed the animals at various intervals of time, and made cultivations from portions of various organs, as well as from the blood, and he found that this was actually what took place, the bacteria, like the pigment granules, being deposited in the liver, spleen, and medulla of bone. This is best seen in the case of non-pathogenic bacteria; when the bacteria are pathogenic to the animal employed they are not limited so markedly to these organs. The non-parasitic bacteria deposited in this way soon die if they do not contain spores. Hay bacilli are all dead in twenty-four hours; lactic acid bacilli die more quickly, very few being found after seven hours. Micrococcus tetragenus, which is not pathogenic in rabbits, does not die quite so rapidly, a few being present even after twenty-four hours. Bacteria live longer when very large quantities are introduced, and Wyssokowitsch adopts the same view in explanation of this which I had formerly suggested, viz., that the large quantity of the products introduced along with the organisms diminishes the vital and destructive activity of the body. If spores are injected, they live very much longer: the spores of penicillium were found alive after seven days; those of bacillus subtilis were found after twelve or sixteen days in large numbers, and in one case some were still alive even after three months.

Lastly, as to the histological elements which are especially concerned, Wyssokowitsch found the various organisms chiefly in the endothelial cells lining the capillary walls. In the spleen they were present in the large endothelial cells in the spleen pulp, and in the kidney they were only exceptionally found, and then in the cells of the interstitial tissue. The spores were also seen in the endothelial cells.

When bacteria are injected into the tissues, there follows a struggle for existence between them and the cellular elements. Leucocytes quickly accumulate in the neighborhood of the mass of bacteria, and then there follows a fight for the mastery between these cells and the bacteria. The cells take up the bacteria into their interior, and where the bacteria are non-pathogenic for the animal employed, they are destroyed and gradually removed by the cells. Where, however, the bacteria are virulent, the cells may undergo degeneration, and the bacteria continue to multiply in the tissues. Metschnikoff has studied the relation of the cells to pathogenic bacteria in daphnis and in the frog. Daphnis is frequently affected with microorganisms. These can be seen under the microscope in the circulating fluid, and the whole process can be studied. To the cells which feed or attempt to feed on the microorganisms, Metschnikoff gives the name of *Phagocytes*. The recovery or death of

the animal depends on whether the cells or the microbes are the victors in this struggle. Frogs kept under healthy conditions do not die of anthrax; if anthrax bacilli are introduced into the lymph-sac, they are quickly seized on by leucocytes and destroyed. If, however, the temperature of the animal be raised, thus favoring the growth of the bacilli, and at the same time lowering the vitality of the cells, the bacilli grow and penetrate into the circulating blood.

The parasitic bacteria differ very much in their seat and mode of action from one another. Some grow on the surface of wounds or on mucous surfaces, penetrating, as a rule, for only a short distance into the underlying tissues; such are the gonococcus, the diphtheritic bacillus, etc. Others grow by preference in the lymph channels (the micrococcus of erysipelas); some grow in the tissues, especially in the cellular elements (the leprosy bacillus, the tubercle bacillus, etc.); and others grow in the blood (anthrax, probably the organisms of the specific fevers, etc.). And there are all sorts of transitions, the same organism growing at times only locally, at others in the bloodvessels. Again, some bacteria are specific on one species of animal and not on another; thus the bacillar septicæmia of mice does not, so far as we know, affect man; while, on the other hand, several infective diseases of man do not apparently affect the lower animals. By using the term "parasitic" in connection with these bacteria, it is not meant that they grow only in the living body. Some, it is true, apparently do so; for instance, the tubercle bacilli have not yet been met with outside the living body, and the conditions required for their growth are not such as are likely to occur in the outer world. Others, again, such as anthrax, live and flourish on dead animal and vegetable tissues, but when opportunity offers they can penetrate and flourish inside the living body.

The conditions necessary to enable these parasitic organisms to enter and live in the living body are manifold, and are as yet but imperfectly known. Some of them may, however, be indicated here. The point of entrance of the bacteria exercises a great influence on the result. The gonococcus, for instance, grows apparently only on the mucous membrane of the urethra, vagina, and eye; the occurrence of inflammation of other mucous membranes from infection with gonorrhœal discharge is very problematical. The cholera and typhoid organisms can apparently only act when they get into the small intestine. The idea that typhoid fever can be acquired by inhalation is extremely doubtful. In other cases the infection cannot occur through an unbroken surface; there must be some abrasion of the surface to which the infective material is applied. This is probably the case with syphilis, and possibly also with erysipelas. Other organisms, again, will only act if introduced into the subcutaneous or submucous cellular tissue, such as the bacillus of malignant œdema of guinea-pigs and mice. Again, in some of the

bacteria which are pathogenic in the lower animals, the infection is only accomplished by introducing the organisms directly into the blood stream. Although a full development of the disease is only obtained in many instances by the introduction of the virus into a particular part, a modified form of the disease is often produced by inoculation in other places. A good example of this is found in the case of symptomatic anthrax (*Charbon symptomatique*, *Rauschbrand*), investigated by MM. Arloing, Cornevin, and Thomas. In this disease the characteristic lesion is an irregular tumor in the subcutaneous cellular tissue, which spreads in every direction, soon crepitates, and in the majority of cases leads to a fatal issue. Here the proper seat of infection is the subcutaneous cellular tissue, and the injection of a considerable quantity of the juice from the tumor into loose cellular tissue is followed by the production of the typical disease. If, however, the injection is made into the tail, where there is very little loose connective tissue, and especially if only a small quantity be used, only a mild form of the disease is produced, and the same is the case when the injection is made into a large vein, care being taken that the material does not run into the cellular tissue. Where a mild form of the disease is thus produced, the animal is protected from a subsequent attack of the virulent disease. I have made out similar facts with regard to a bacillus first described by Hauser under the name of *Proteus vulgaris*. In my first experiments with this organism, I found that rabbits died after injection of a considerable quantity into the back. Carrying on the investigation still further, I got irregular results; some animals dying, others not. Further investigation of the matter revealed the fact that in the animals which died the injection had passed into the muscles of the back; while in those which lived it had only gone into the subcutaneous cellular tissue. The same result was obtained when the thigh was the seat of experiment. Injection of a given quantity into the muscles was followed by death; into the subcutaneous cellular tissue the result was not fatal. In the animals which died, a few bacilli were found in the blood of the heart; but there was no marked multiplication in the blood, as in the case of anthrax and other blood diseases. While the fatal result was obtained only where the injection was made into the muscles, abscesses resulted after injection into the cellular tissue, and these animals did not succumb after subsequent injection into the muscles, an abscess then being the only result. When this subject is studied more closely, other facts will no doubt be made out of a similar kind with regard to other diseases.

A very important point in regard to infection, and one on which stress has not been sufficiently laid, is the dose of the virus which comes into action. This is a matter which I have been lately investigating, and as the facts obtained are of great importance, I may briefly indicate my

results.¹ Among the questions to be considered, the following are the chief: Can a single pathogenic bacterium produce the disease, or must a number be introduced in the first instance? Is there any difference in the severity of the disease when the primary dose is large or small? At first sight, one would say that if the virus is self-multiplying, if it is a bacterium, for instance, it can make no difference to the ultimate result whether the initial dose was large or small; the only difference it could make would be in the length of the incubation period. In laboratory cultivation experiments one finds that a single bacterium planted in a suitable soil will grow and produce the characteristic changes in that soil with the same certainty as if a large number were introduced. But, as I shall immediately point out, this is not the case with all pathogenic bacteria in their action on the living body.

The results of my experiments, which, however, are not yet completed, and to which I shall, therefore, not refer in much detail, are briefly the following. In certain cases the introduction of a single bacterium into an animal is sufficient to set up the disease. Thus one anthrax bacillus injected subcutaneously will kill a guinea-pig as certainly as would 1000, though after a longer time. One bacillus of chicken cholera or rabbit septicæmia will kill a rabbit. One bacillus of mouse septicæmia will kill a mouse. This is the case where the animals are very susceptible to the disease, but if the bacteria are introduced into less susceptible animals the result is different. Thus chicken cholera does not naturally affect guinea-pigs, but if the bacilli are introduced in large numbers into the subcutaneous tissue the animal may die. I have not, however, been able to kill guinea-pigs with chicken cholera if less than 100,000 bacilli were introduced, unless, indeed, they were injected into the peritoneal or pleural cavity. Chauveau² found that the same held good in the case of anthrax and Algerian sheep; a minute dose did not kill. *Staphylococcus pyogenes aureus* and *albus*, and Sternberg's micrococcus (from cultures) do not kill rabbits if only a single organism be introduced, considerable numbers are necessary (in the case of the staphylococci, for instance, several millions) to cause death. But in all these cases, where large numbers are requisite in order to produce a fatal result, a smaller dose will produce a local effect in the form of inflammation, abscess, or necrosis of tissue. Here, also, there is a limit; in guinea-pigs, for instance, less than 10,000 chicken cholera bacteria produce no effect at all. But there is a further most important point in connection with this matter, viz., that in many cases the small dose which produces a local effect, at the same time protects the animal from the fatal result if a larger dose be subsequently introduced. Chauveau, for instance, found that while small doses of anthrax bacilli did

¹ See paper by the author "On Certain Conditions of Infection," *British Medical Journal*, July, 1886.

² *Comptes Rendus*, 1880.

not kill Algerian sheep, they were able to render the animals immune from subsequent injection of large doses. In *charbon symptomatique* similar facts have been made out. The injection of a very small quantity of the virus into the subcutaneous cellular tissue produces, in many instances, only a slight local disturbance, and when this has passed off the animal is found to be protected from subsequent attacks of the disease. Hauser's bacillus (*Proteus vulgaris*) illustrates these points very well; in fact, this was the first organism with which I experimented in regard to the question of dose, and the results obtained with it led me to direct my attention to the local and protective results of small doses. A large dose (one-tenth cubic centimetre) of a cultivation of this organism in nutrient jelly injected into the muscles of rabbits causes the death of the animals within twenty-four hours. A small dose (one-fortieth cubic centimetre) of a similar culture is followed by suppuration and necrosis of the muscle, but not by death. A subsequent injection, a few days later, of a fatal dose into another muscle is not followed by a fatal result, but only by a local abscess. I may mention two laws which have resulted from my research, and which I think important as throwing light on the spread of epidemics; but for the discussion of the whole matter I must refer the reader to the paper previously mentioned. The two laws are, 1. The pathogenic dose of a virus varies inversely with the susceptibility of the animal to the disease; 2. In animals not very susceptible to the disease the pathogenic effects of a virus vary directly with the dose primarily introduced.

How far these facts are applicable to infectious diseases in man remains to be investigated, but the fact that such differences do exist as the result of the dose of many viruses, and the fact that the predisposition to the disease influences the effect of a given dose must be borne in mind in future in studying the question of infection in man. I may indicate one or two instances in which such a difference in result is likely. As the result of the introduction of the *Bacillus anthracis*, we know two effects in man: the formation of a malignant pustule, from which the patient may recover, and the general fatal blood disease. May not the difference in the result in these two cases depend, to some extent at least, on the primary dose? In an individual not predisposed to this disease, may it not be that a dose which, in another person, would produce the general fatal disease, causes in him only a local effect? Indeed, in man we have no evidence that in any case a single anthrax bacillus can cause a fatal result, as it does in the case of guinea-pigs. Cholera is a disease in which this matter of dose probably plays a very important part. From a consideration of the modes and spread of infection in this disease, it is in the highest degree possible that a single cholera bacillus would not produce any effect, that a few would be followed by only a slight diarrhoea, which might protect the patient, for a time at least, from a fatal

dose, and that only a comparatively large dose is followed by the typical disease. Here, again, of course, the question of predisposition would come into play, and a dose which, for one individual, would produce a fatal effect, would cause only a passing derangement in a less susceptible individual. Whether this holds good in relation to diphtheria, tuberculosis, and other diseases, is a matter for investigation. It is possible that the local tuberculoses may be, to some extent at least, determined by a small dose in the first instance, but that is purely a speculation.

In the case of the pyogenic organisms, however, this matter of dose is probably of great importance. Ogston has supported the view that the difference between a slight suppuration or abscess and pyæmia is a difference of dose, and though formerly inclined to doubt this view, I must confess that it now seems to me to contain much truth. My experiments on rabbits with the staphylococcus showed that the matter of dose was a very important one, a large dose killing the animal, a medium dose causing an abscess, and a small dose remaining without effect. What adds the greatest probability to this view is that the organisms found in pyæmic abscesses, and which are evidently the cause of these, are the same as those found in local suppurations and abscesses, and it is difficult to see what other explanation can be given of this fact. At first I was inclined to the view either that the organisms found in pyæmia, though similar morphologically, were really different from those present in acute abscesses, or else that they were accidentally present, and that the true organisms of pyæmia had not yet been discovered; but the researches of Rosenbach, which have demonstrated that the organisms present in pyæmic abscesses are really the same as those of ordinary suppurations, and my own researches showing the actual existence of different effects as the result of different doses, have led me to believe that Ogston's views are probably to a considerable extent correct.

It is difficult to understand the meaning of the fact that in many cases a large number of bacteria are required to produce an effect, but the following seems to me to be a probable explanation: In the fight which occurs between bacteria and the tissues in the body, when the former are victorious it is probably in many cases due to the effect of the poisonous chemical products which they produce. When the animal is not particularly predisposed to the disease, the tissues are able to resist these products and to destroy the bacteria. Where, however, the bacteria are present in large numbers, such a large quantity of this poison is introduced as to weaken the cells, give the victory to the bacteria, and lead to the death of the animal. Where the number of bacteria is less, their victory is only partial, and a local affection is the result. That the chemical products have a good deal to do with the ability of bacteria to take root in a body is shown by the following experiment. I have stated with regard to *Proteus vulgaris* that while one-tenth cubic centimetre of

a gelatine cultivation injected into the muscles of the back of a rabbit caused the death of the animal, the use of one-fortieth cubic centimetre produced only an abscess. In order to inject one-fortieth cubic centimetre accurately I have generally added one cubic centimetre of the cultivation to three cubic centimetres of boiling distilled water, or of sterilized meat infusion, and then injected one-tenth cubic centimetre of the mixture. If, however, instead of using boiled distilled water for dilution I use a cultivation of these organisms in meat infusion, boiling the infusion before use in order to kill the bacteria, I have found that in most cases one-tenth cubic centimetre of this mixture causes the death of the animal. Here a larger quantity of the products than usual was introduced, and enabled the bacteria to cause the fatal result. It must not be supposed that these animals died solely of chemical poisoning, the examination of the blood and tissues showed clearly that death was due to the multiplication of the bacteria.

Among other conditions necessary for infection we have predisposition to the disease on the part of the patient. The predisposition to disease varies greatly in different individuals, and undoubtedly plays a very important part in the spread of infective diseases. It is difficult to define exactly what is implied by the term predisposition. It may mean some slight difference in the chemical constitution of the body, the excess of some element which is noxious to the development of the bacteria in question, or the deficiency of some substance which is necessary for their vigorous growth. It may, however, mean only a greater or less vitality and resisting power on the part of the cellular and tissue elements leading to more rapid and complete destruction (or the contrary) of the parasite. It is highly probable that the resisting power of the cellular elements at the time of attack plays a greater part than some supposed difference in chemical constitution of the body, and the facts previously mentioned in regard to the dose showing that the resistance of the animal may be overcome by increasing the dose of the virus, tends to support this view, for if the soil were chemically unsuitable for growth it is not easily conceivable that the introduction of a larger number of bacteria would render it more suitable. Predisposition is not only general but local. An individual may be in weak health and yet resist the disease if only the local part exposed to attack be healthy; while, on the other hand, a person may be in good health and yet be attacked by the disease if the point of entrance of the poison be in a weak state. It is generally supposed that something of this kind occurs in tubercular infection. In the case of tuberculosis of the lung it is assumed that in addition to inhalation of bacilli there must be some local catarrh or some interference with the circulation in the apex of the lung, rendering it more liable to attack than if it were in a healthy state. In several infective diseases the existence of a wound or some diseased condition of the part exposed

to attack is certainly necessary. In considering the question of pre-disposition we have to remember the well-known fact that immunity, at any rate of a temporary character, follows an attack of many diseases. What it is that occurs to prevent the same bacteria from taking root a second time in the same body, is quite unknown, but here also the probability is that in some way or other the tissues of the body have become endowed with special powers of destroying these organisms. This is a more probable view than that which assumes that something has been added to or taken away from the body, rendering it an unsuitable soil. Whatever it may mean, protection may be brought about in various ways. A severe attack of the disease may leave the body protected; a mild attack may do the same, the mildness of the attack depending again on the seat of infection, on the dose of the virus, etc. Or, again it may be brought about by the introduction of a virus of less virulence than that which ordinarily causes the disease.

This last fact leads us to the question of the attenuation of virus and protective vaccination. Toussaint and Pasteur were the first to prove that the virulence of bacteria varied according to the conditions under which they were placed. Pasteur found that by keeping cultivations of the microbe of fowl cholera in chicken infusion for some time the organisms gradually lost their virulence, till after some months they were no longer able to give rise to the disease, but in the intermediate stages they were of various degrees of virulence, decreasing as the cultivations became older. Fowls inoculated with cultivations some three months old became ill, as a rule, but recovered and after recovery they were found to be protected against the virulent disease. Pasteur came to the conclusion that it was the prolonged exposure to oxygen which led to the diminution of the virulence, and showed that where flasks were filled about three-fourths full of liquid, inoculated with the microbe, and then sealed with a blowpipe, growth occurred slowly and even after nine months the bacteria still retained their full virulence. The bacillus of anthrax has also been attenuated and animals protected with it in various ways. Pasteur attenuates it by cultivating it in flasks containing a thin layer of fluid at a temperature of 42° to 43° C. After about six weeks the organisms, though still alive, do not kill any animals. When somewhat less old they kill only mice, still earlier (before the tenth or twelfth day, according to the temperature) they kill mice and guinea-pigs, but not rabbits. Koch finds that the attenuation here probably depends more on the temperature than on the oxygen. Toussaint, who was the first to attenuate the *Bacillus anthracis*, did so by heating the defibrinated blood of an animal which had died of anthrax to a temperature of 55° C., and keeping it at that temperature for ten minutes. This method is very uncertain; in some cases the bacillus is really attenuated and may serve as a vaccine; in others, it retains its virulence and kills sheep; in

others, again, it is killed. Chauveau has also published facts which show the great effect of heat in attenuating the bacillus.¹ He inoculated sterilized meat infusion from the blood of an animal which had died of anthrax and kept it at a temperature of 42° to 43° C. for twenty hours. He then removed it to a second incubator heated to 47° C. According to the length of time during which the cultivations were kept at the latter temperature, the organisms varied in virulence. Before being placed at 47° C. they killed guinea-pigs within forty-eight hours, after being kept at 47° C. for one hour they still killed guinea-pigs, but after a longer time. If kept for two hours at that temperature, a considerable number of the animals recovered. After three hours no fatal effect was produced.

Pasteur's theory of the attenuation of the *Bacillus anthracis* was that at 42° C. spores were not formed, and that, therefore, the oxygen was able to act on the adult organisms and cause their loss of virulence. Apart from the fact that spores are formed at this temperature other experiments, and especially those of Chauveau, show that the oxygen is not the cause of the attenuation. Chauveau found that in vessels from which the air had been removed by means of the air-pump attenuation occurred more rapidly at 47° C. than when oxygen was present. Attenuation can also be effected by the addition of chemical substances to the cultivations. Thus, the addition of $\frac{1}{6000}$ th part of carbolic acid to an infusion does not, according to Chamberland and Roux, prevent the growth of the bacilli, but, nevertheless, the bacilli gradually lose their virulence so that after twenty-nine days they do not kill either rabbits or guinea-pigs, and vaccines of intermediate strength are obtained at an earlier period. The addition of $\frac{1}{2000}$ th to $\frac{1}{5000}$ th part of bichromate of potassium produces similar results. The authors further state that the diminished virulence thus obtained is retained in subsequent cultivations in materials not containing these antiseptic substances, just as appears to be the case with cultures attenuated gradually at 42° to 43° C., while in Toussaint's and Chauveau's methods the full virulence of the organism is subsequently regained on cultivation in fresh materials at the ordinary temperature.

How far the results are applicable practically is a matter of dispute. Pasteur holds that they are, and he has already inoculated large numbers of sheep and cattle. He recommends the use in the first instance of a very weak vaccine, and subsequent inoculation ten days later with a stronger. Koch states that the first vaccine should kill mice but not guinea-pigs and rabbits, while the second should kill mice and guinea-pigs but not rabbits. Koch also holds that the losses after vaccination sufficient to insure complete protection of sheep will be greater than

¹ Comptes Rendus, tome 96.

from the natural disease. Pasteur says that such strong vaccines need not be used, because he thinks that the natural infection is less virulent than the artificial one. Koch asserts the opposite, on the ground of experiment. He fed sheep which had previously been vaccinated with large quantities of spores, and two out of seven of them succumbed to anthrax, although all seven had previously withstood a control inoculation with very virulent materials. On these grounds Koch declares against the introduction of protective vaccination of sheep for anthrax. In this matter I venture to differ from Koch, and am inclined rather to agree with Pasteur as to the utility of his protective vaccinations. His statistics, which seem satisfactory, show a great diminution in the number of deaths from natural anthrax after protective vaccination on farms previously much ravaged by the disease, while apparently there has not been much loss as the result of the vaccinations. It may be quite correct, as Koch says, that infection from the intestinal tract is in reality more virulent than the artificial, and yet, nevertheless, the animals may be sufficiently protected to resist it. I look on an inoculated animal, even though not absolutely protected, as an animal less predisposed to take the disease than an uninoculated one. As we have seen before, less susceptible animals require a larger dose of a virus than those which are more susceptible. Hence these inoculated animals would require a larger dose of the virus to kill them than the uninoculated, and, therefore, the question is: Is it likely that in natural infection animals usually receive a large dose? I think this is most probably not the case, and that they are in most cases sufficiently protected to be able to resist the small dose they would usually take in, and which, without this partial protection, would prove fatal. In Koch's experiments he administered large doses of spores to his vaccinated sheep. I should doubt if it is often the case that animals when grazing would take in anything like the same amount at one time. Of course, I admit that this is pure speculation, but it is a point that could be easily tested, though, unfortunately, I have not the opportunity of doing so. Pasteur's statistics are very striking, and deserve attention, while Koch has definitely shown that these animals are not necessarily absolutely protected. Hence, an explanation must exist for Pasteur's success, and the one I have attempted to give seems to me very probable. Among other objections urged against protective vaccination it is said that it would increase the disease by spreading the organisms, but this is a very shadowy objection and one which ought to be easily overcome in practice. It is interesting to note that the attenuated organisms do not, according to the most trustworthy researches, regain their virulence on further cultivations.

The degree of virulence of a pathogenic organism may also be altered in other ways. In the course of Pasteur's interesting researches on

swine plague he found that pigeons inoculated with the virus of swine plague died in six to eight days after suffering in the first instance from symptoms like those of fowl cholera. If the disease is transmitted from pigeon to pigeon, the organism after a time acts more violently, and the animal dies sooner. If, now, pigs are inoculated from these pigeons, death occurs more quickly than when inoculated from a pig, the organism having become more virulent. With the rabbit the converse is the case. The virus kills rabbits, but if it is passed through a series of rabbits it is no longer able to kill pigs. Although, however, it does not kill the pigs, these animals are rendered immune by inoculation from rabbits against the virulent disease. Pasteur has also made out similar facts with regard to rabies. If the poison of rabies is passed through a series of rabbits it becomes more virulent. If, however, it is passed through monkeys it loses its virulence, and dogs inoculated from the affected monkeys are rendered refractory to rabies.

In order to attenuate the virus of rabies Pasteur now employs another method. Small portions of the spinal cord (a few centimetres long) from an affected rabbit are suspended in dry air in flasks. After a few days the virulence of the cord rapidly diminishes, till at last it is entirely destroyed. Animals may be protected from rabies by injecting portions of the cord which have been suspended in this atmosphere for various lengths of time. Pasteur attributes this attenuation to the action of oxygen, because he does not find that it takes place if the vessel be filled with carbonic acid gas instead of air.

Besides these various conditions of infection, there are without doubt others which we do not as yet know. For example, we cannot explain satisfactorily why certain infective diseases at one time only appear in a sporadic form and at another as epidemics. Nor is the influence of season on the spread of epidemics an easy matter to understand. We must wait for further inquiry into the life history of these microparasites and their relation to the living body to throw more light on these subjects. But on the other hand, although we may not be able to understand all at once the exact *modus operandi* of any particular microorganism in the production of a disease, that is no reason why we should reject evidence which points to a relation between a bacterium and a disease, nor the conclusions which analogy would lead us to draw from such evidence.

Having now considered the conditions of infection, we must study a little more closely the relation of these parasites to the living body. I have already referred to the question of septic intoxication. By this term is meant the absorption of poisonous substances produced by bacteria, these bacteria, however, being non-pathogenic—*i.e.*, unable to live and grow in the tissues of the body. I have referred to one of the effects of septic intoxication, *viz.*, the rapid death of the patient, but

this can only occur when the wound is extensive and where there is a large amount of fluid contained in it in which the bacteria can grow. When the quantity of poison absorbed is less than is required to produce a fatal result, febrile symptoms are caused, and continue either till absorption can no longer occur or till the growth of the particular organism ceases. This mild septic intoxication is the cause of the traumatic fever which follows operations. That this fever is due to bacterial development is shown by the fact that it is absent in cases treated aseptically, in which bacteria do not enter and grow in the wounds. This fever lasts for three or four days, and then subsides coincidently with the establishment of granulation and the consequent formation of a barrier to absorption. The particular organism or organisms which give rise to this poison are not definitely known. Hauser thinks that the bacteria described by him under the name of *Proteus*, more especially the *Proteus vulgaris*, which are often present in putrefying discharges and gangrenous tissues, and which give rise to a substance which is very poisonous to certain of the lower animals, are the common agents. It is possible, however, that it is not always the same bacterium nor the same poison which is at work.

It is not, however, only from wounds in the skin that septic intoxication occurs; the same, no doubt, takes place from the uterus after delivery, constituting one form of puerperal septicæmia; and it is also probable that from the intestine poisonous substances produced by non-pathogenic bacteria may be absorbed and give rise to illness, diarrhœa, and, it may be, death. In fact, cholera is a disease closely allied in its pathology to septic intoxication, although the cholera bacillus must be classed among the parasitic organisms. The generally accepted pathology of cholera is that the intestinal canal is the seat of the virus, which grows there and produces a poison, on the absorption of which into the circulation all the other symptoms depend. But few competent observers doubt now that the cholera bacillus discovered by Koch is in reality the virus of the disease. The evidence in favor of the bacterial origin of this disease is very strong, and no other organism has been found to which, by any possibility, could be assigned the rôle of cause, while the facts in favor of the cholera bacillus as the real agent are very striking. The probable course of events is that this bacillus grows in the contents of the small intestine and produces an intense poison, which being absorbed, and perhaps also acting locally, sets up the various symptoms. After a time apparently the bacillus may penetrate for a short distance into the coats of the intestine, especially toward the lower end of the ilium, but this phenomenon is in all probability purely secondary and of little influence on the course of the disease, the poisonous material being in reality produced in the contents of the intestine and not in its walls. The objection which has been urged against this view is that absorption

could not occur from the intestine during the stage of diarrhœa. This, however, is merely an assertion not founded on any evidence, and there seems no good reason why absorption might not go on by the lymphatics and lacteals at the same time that fluid was being poured out by the bloodvessels. Indeed, there seems every reason to believe that remedies such as opium are absorbed not only from the stomach, but from the intestine during the acute stage of the disease. And even though absorption at this stage was difficult or impossible, the probability is that the main quantity of the poison which comes into play is absorbed before the most acute stage is reached, and that the loss of large quantities of the fluid part of the blood plays a great part in the subsequent phenomena. This disease probably stands on the border-line between true septic intoxication and the typical parasitic disease.

In many of these parasitic diseases the bacteria grow only locally, and from the local centre exert their influence on the body. It is difficult to see in what way the general disturbance can be caused, except by supposing a local production of poisonous substances which are carried into the circulation, and thence exert their deleterious influence. A striking example of what I believe to be a purely local disease in the first instance is diphtheria. What the exact relation of microorganisms to diphtheria is has not yet been satisfactorily made out; but, according to Löffler's researches, it seems most probable that diphtheria proper (as distinguished from diphtheritic sore throat occurring in connection with other diseases) is due to a bacillus. In diphtheria of the throat this organism grows in the superficial layers of the mucous membrane, and rapidly spreads along the surface. As the result of its growth, a large amount of fibrinous exudation is poured out, and the cells of the mucous membrane in the affected areas die. The constitutional disturbance seems to be due entirely, at any rate in the first instance, to absorption of chemical products from the local growth, and not to the entrance of the living virus into the blood. Löffler did not find these organisms in the bloodvessels or in internal organs, except in one or two instances, where they were present in the alveoli of the lungs and in the liver, and in these cases Löffler ascribes their presence to post-mortem changes.¹ It must be admitted that this view of the pathology of diph-

¹ This pathology of diphtheria is opposed to the teaching of many, that diphtheria is a general blood disease with a local eruption, and accordingly, if correct, various important changes must be made in the treatment of this affection. Holding that diphtheria is, in the first instance at least, a purely local disease, I have used in several cases energetic local treatment with considerable success, the treatment being based on an attempt to destroy these organisms and prevent their spread. In order to accomplish this, it is necessary to remove all false membrane as thoroughly as possible by means of forceps, etc. I then paint the surface of the throat, especially the part affected, with a 1 to 500 watery solution of corrosive sublimate, repeating the application every hour, care being taken that this solution does not run down into the stomach and set up intestinal irritation. The patient has at hand a gargle of 1 to 2000 sublimate solution, with which he washes out his throat frequently; and I have also sprayed the throat from time to time with a 1 to 40 carbolic acid solution. The result of this treatment supports the local pathology of diphtheria, for I have seen an extensive sthenic affection of the throat treated in

theria leaves the after-paralysis unexplained; but, on the theory that this is a general disease with a local manifestation, this phenomenon is equally difficult to understand. The idea that it is due to spread of bacteria along the nerves, or to a neuritis, does not seem to be satisfactory.

This view of the absorption of a poison from a local source, giving rise to general constitutional symptoms, apparently holds good in a number of local infective diseases, both acute and chronic. In erysipelas the micrococci which have been shown to be the cause of the disease seem to spread only in the lymphatic vessels of the skin, and have not as yet been found in the blood, although in this disease there are very marked constitutional symptoms. In most cases of septicæmia, also, the micrococci seem to be limited to the neighborhood of the wound, and are not found in any quantity in the blood. The term septicæmia, however, probably includes a number of distinct diseases, in some of which the microorganisms grow locally only, in others multiply in the blood, as in the corresponding disease in rabbits, mice, etc. In other local affections, such as phthisis, the fever and the general symptoms which accompany them are also probably due, in part at least, to absorption of noxious substances from the local disease.

In typhoid fever we have a transition between purely local diseases and general or blood diseases. In typhoid fever we have apparently in the first instance a purely local affection, the infection probably commencing from the intestine. The bacilli, in the first instance, seem to penetrate into and grow in the lymphoid follicles of the small intestine, leading to swelling, and ultimately to ulceration of Peyer's patches and the solitary glands. After a time the bacilli, carried along by the

this way, in which the temperature fell very quickly after the treatment was commenced. This would hardly have been the case were diphtheria a constitutional disease.

These views ought, I believe, also to influence the question of tracheotomy in diphtheria. The general rule as to performing tracheotomy is to wait till there are definite signs of obstruction of respiration, the only object of the operation being to permit the free entrance of air. This view I hold to be entirely erroneous, and I believe that much might be done by performing tracheotomy early, in the way of preventing the spread of false membrane downward into the lung. I would suggest the opening of the trachea as soon as it is certain that the larynx is affected, and this opening should not be made merely with the view of inserting a tube, but with the view of applying medicaments to the trachea and larynx in the same way as I have indicated in the case of the pharynx. Hence a large opening should be made to enable the operator to see into the trachea easily. If the trachea is healthy, the membrane not having reached it, it seems advisable to attempt, by means of a brush, to apply the strong sublimate solution to the larynx through the vocal cords, and then to pack the upper part of the exposed trachea with gauze dipped in a 1 to 2000 or 1 to 3000 sublimate solution, leaving sufficient space at the lower part for the insertion of a tube. This plug could be removed every two or three hours, with the view of seeing whether the disease was spreading downward. It seems unlikely that it would spread under this solution; but if it were found to do so, the membrane could be scraped off, and the surface touched with the strong solution. This looks at first sight a severe measure, but in reality it would, I believe, be free from danger; and, considering the great risk to the patient when once the membrane begins to spread along the air passages, it is, I think, worth trying. Unfortunately, diphtheria is reckoned as a medical disease, and the surgeon is rarely called in till the time has passed for such treatment. Hence I merely throw out the above method as a suggestion; for, although experience would probably show that the details require modification, the principle seems to me to be sound.

lymphatics to the mesenteric glands, seem to penetrate into the blood, and are found in the great majority of cases in the form of plugs in the bloodvessels in various organs, more especially in the liver, spleen, and kidneys. At what period of the disease the organisms reach the blood, whether they always do so, and what are the exact relations which exist between the local and the general disease, are not known.

Of general diseases in men—*i. e.*, where the bacteria inhabit the blood—but little is known. It is probable that the various specific fevers are due to bacteria, but, although in some instances micrococci have been found, there is no certainty that these organisms are the cause of the disease. Anthrax in man, occurring under the name of woolsorter's disease, is frequently a general disease, though many cases occur in which it is, in the first instance at least, purely local. In man, also, relapsing fever has been shown to be connected with the development of a spirillum in the blood. In pyæmia and ulcerative endocarditis micrococci grow in the blood, but they are very soon deposited in the capillaries in various organs as emboli, and these conditions are hardly comparable with general bacterial blood diseases like anthrax. In the lower animals a number of general diseases are known in which the bacteria grow in the blood and cause the death of the animal; such are the bacillar septicæmia of mice, chicken cholera, rabbit septicæmia, the septicæmia of mice and rabbits caused by Sternberg's micrococcus, etc. Death may be brought about in this instance in various ways; just as in the case of the local affections a poison may be developed as the result of the growth of the bacteria in the blood which set up the symptoms; or the bacteria, living in the blood, may remove materials from it, among others oxygen, which are necessary for the life of the animal; or, again, the enormous numbers of bacteria present in the blood, and especially in the capillaries, may set up serious circulatory disturbances, which may, at the least, aggravate the general symptoms. The cases in which the blood simply serves as the vehicle for the dissemination of a disease, as in acute tuberculosis, must not be confounded with the above.

The local effects of bacteria are very various, and differ in the case of almost every bacterium. They may also, in most cases, be explained by supposing a local action of a poison originating as the result of this growth of the bacteria. The poison, however, is evidently not the same in all cases—indeed, it is probably different in every instance. The most violent of the local effects of bacteria are seen in various gangrenous affections (acute traumatic gangrene and noma). Here it is not a case of death of the tissues as the result of violent inflammation, so much as a direct killing of them by the products of the bacteria. In acute spreading gangrene bacilli have been found which are apparently the cause of the disease. In noma long bacilli are present, which Mr. Lingard has demonstrated to be the cause of the disease. In gangrenous

stomatitis in the calf, which affects calves at particular seasons, he has found bacilli which are very similar in appearance to those present in noma in man. On cultivation they present characters which render them easily distinguishable from other bacteria, and on inoculation of these organisms into the calf a gangrenous stomatitis is again produced. A somewhat similar affection, though less violent, was studied by Koch in connection with mice, in which a progressive gangrene of the tissues was caused by the growth of a streptococcus in them.

Another set of local phenomena caused by bacteria are inflammatory, and in connection with these, micrococci of various kinds are generally present. In inflammation in man two kinds of micrococci are chiefly found: streptococci, where the individual cocci are arranged in chains, and staphylococci, where they are arranged in groups. Of the latter there are several kinds. The streptococci are generally found in connection with violent phlegmonous inflammation, where there is a tendency to necrosis of tissue with but little suppuration; the staphylococci are chiefly found in abscesses. The conditions under which abscesses arise in connection with these organisms are not very clear; I believe that local injury or weakening of the part is necessary in most cases, and that the primary dose is of great importance. That these organisms act by the production of poisonous or irritating materials seems certain, for if injected into the blood-stream in animals (and in man in pyæmia and ulcerative endocarditis) they give rise to emboli in various organs, and in stained preparations of these organs it is seen that the tissues in the immediate vicinity of the embolus do not stain, they are dead (coagulation-necrosis), while, at some distance off, a ring of leucocytes is formed which encloses the organisms. It is clear that the tissue in the immediate vicinity of the mass has been killed by some poisonous excretion, which, at a further distance, has been more dilute, and has only acted as an irritant. In connection with the pyogenic micrococci, it is interesting to observe that the same organisms are found in pyæmia, more especially the streptococci. Probably the difference in dose plays an important part in the different action of these micrococci, nevertheless I cannot but think that some other conditions, with which we are as yet unacquainted, must come into play.

A third set of phenomena may be observed as the result of the local action of bacteria, viz., formative and degenerative processes. In tubercle we have something more than a merely inflammatory process; we have a distinct formation and transformation of cells as indicated by the appearance of large numbers of epithelial cells, and also of giant cells at an early stage of the process. The tubercle bacillus seems at first to grow by preference (where it can) in epithelial (as in the alveoli of the lung) or endothelial cells, leading, in the first instance, to their hypertrophy and multiplication, but, bye and bye, to their degeneration and

caseous transformation. In the case of some cells, however, the vitality of the cell seems to be unusually great, and thus they go on growing, leading to the formation of a giant cell. A tubercle illustrates very well the fight between cells and bacilli. If the cells are the weaker they quickly die and undergo degeneration, and thus the centre of the tubercle becomes converted into a caseous mass, in which the bacilli may, for a short time, continue to grow. If, however, the cells obtain the victory, the bacilli soon disappear, and a "fibrous tubercle," containing giant cells, is left, in which few or no bacilli can be found. These are the tubercles which, on account of the absence or small number of the bacilli, have led to the formation of various theories as to tubercle being due to a chemical poison, etc. These theories, however, depend, I believe, on misinterpretation of the facts; such tubercles are rather to be regarded as tubercles in which the bacilli have been already destroyed than as growing nodules. Other examples of the formative action of bacteria are seen also in syphilitic affections and in leprosy.

THE SURGERY OF THE PANCREAS, AS BASED UPON EXPERIMENTS AND CLINICAL RESEARCHES.¹

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CYSTS OF THE PANCREAS.

FOR a general consideration of this part of our subject I refer to my paper on "The Surgical Treatment of Cysts of the Pancreas," in the number of this journal for July, 1885. I allude to this subject again for the purpose of adding new cases and to modify the statement then made concerning the etiology of these cysts. Since then the following additional cases have been reported.

CASE I.—Dixon (*Medical Record*, March 15, 1884) reports an interesting case of cyst of the pancreas, which terminated in death from compression of the bile-duct by the cyst. The patient was a male, forty-two years of age, who during a period of three months had suffered from three attacks of what seemed to be cholelithiasis, before he came under the reporter's care. For the last ten days he became jaundiced. On examination a tumor was found in the region of the gall-bladder, about four inches in diameter, which fluctuated on palpation and ascended and descended synchronously with the respiratory movements, and received the impulse from the underlying aorta. The tumor was punctured and four ounces of a yellowish-red fluid removed which solidi-

¹ Read before the American Surgical Association, Washington, D. C., April 29, 1886.

fied on exposure to the air. Two days after the puncture the tumor was considerably larger than before. The patient's strength gradually failed, until he died, thirty-four days after the puncture. At the necropsy it was ascertained that the tumor was a cyst of the pancreas, with thick walls, and light yellow mucous contents. The cyst occupied the head and part of the body of the pancreas and communicated with the ductus pancreaticus. The tail of the pancreas also contained a small cyst. The large cyst compressed the ductus choledochus in such a manner as to render it entirely impermeable. It is evident that in this case a removal of the pressure by operative treatment might have restored the health of the patient by removing the cause of obstruction to the natural outlet for the bile.

CASE II.—Reported by Riedel (*Archiv für klinische Chirurgie*, vol. xxxii, p. 994). A woman, forty-five years of age, noticed nine years ago a small tumor in the upper portion of the abdomen, which increased slowly in size until a year and a half before she was examined by Riedel. After this time growth was very rapid, so that a great deal of pain and distress was experienced from the size of the tumor. When she was examined the abdomen was filled completely with a fluctuating tumor, the pelvis and the lateral regions of the abdomen were free. Laparotomy was performed August 27, 1884. The slightly adherent omentum was easily separated, the cyst was tapped, and about ten litres of a brownish fluid escaped. After evacuation of the cyst, the transverse colon could be seen immediately behind the symphysis pubis. The mesocolon had been separated with the omentum. The cyst was separated from the loose attachments with neighboring organs. Troublesome hemorrhage only occurred from the depth of the wound near the vertebral column, where a ligature *en masse* was applied and several vessels tied; the cavity of the wound, the size of two fists, was dusted with iodoform. Death from peritonitis after ninety-six hours. At the necropsy a portion of healthy pancreatic tissue was found ligatured with catgut. The interior surface of the cyst showed, for the most part, a smooth surface without epithelium. At different points it presented prominences which contained glandular tissue.

CASE III.—Reported by Salzer from Billroth's clinic (*Zur Diagnostik der Pankreaszyste*, Prag, 1886). Female, thirty-three years of age, not married, was sick with typhus fever when she was eighteen years old. She stated that during her convalescence she noticed a swelling the size of a goose egg in the middle of the abdomen above the umbilicus which disappeared in a few weeks. Four years later the swelling reappeared in the same place, was the size of a fist, but little movable, and rendered the umbilical region prominent. The size of the tumor increased gradually until four years ago it had attained the size of a foetal head, and had descended below the umbilicus. A sensation of weight in the stomach, vomiting, pain in the abdomen, were the most prominent symptoms during the last fourteen days. Menstruation regular. Before the operation a systematic and careful examination showed no disease in any other organ. Circumference of abdomen below the umbilicus, ninety centimetres. An unusually large vessel was detected in the abdominal walls in the left hypochondrium, which pulsated strongly, and over which, by auscultation, a bruit could be heard. Abdomen prominent, especially in the median line. On palpation the swelling was recognized as a round, smooth, fluctuating tumor, which was in direct contact with the anterior abdominal wall and could be moved slightly from side to side. Percussion dulness over the entire area of the tumor. Both lumbar regions resonant. Spleen and kidney dulness normal. A vaginal and rectal exploration showed that the cervix and uterus were pushed toward the right side, but movable. Behind the uterus a firm tumor could be felt. The diagnosis made at the time was unilocular cyst of the left ovary. Laparotomy was performed June 5, 1885. Median incision exposed the omentum over the cyst, slightly adherent. An opening was made in the omentum, with blunt instruments, through which the cyst wall became visible. The hand introduced through this opening showed the existence of firm adhesions of the cyst wall to neighboring organs. After enlarging the external incision the gastro-colic ligament could be seen stretched over the cyst.

The transverse colon lined the lower border of the cyst, and had descended behind the symphysis pubis. When this portion of the intestine was elevated it was seen that the cyst belonged to the mesocolon. The separation of the cyst presented many difficulties, consequently its size was reduced by tapping, the opening was closed with pressure forceps, and enucleation commenced through a vertical slit in the gastro-colic ligament. Numerous mass ligatures had to be applied to arrest troublesome hemorrhage.

On the left side of the cyst the same enlarged vessel was met with that could be felt externally; it was found so intimately adherent to the cyst wall that it could not be isolated; it was, therefore, ligated double with the accompanying vein, and divided between the ligatures. To facilitate the deep dissection the incision was enlarged upward, and the cyst opened and emptied with the patient lying upon the side. The hand was introduced into the cyst, when it was found that the attached portion extended in an upward direction. The artery previously ligated had to be tied again higher up. In completing the tedious enucleation no pedicle was found.

From the position it could be ascertained that the base of the cyst was in the vicinity of the pancreas.

After careful arrest of hemorrhage at the bottom of the wound, and usual toilette of the peritoneum, the external wound was closed completely, no drainage being used. The patient, who had become considerably collapsed, was rallied by the administration of stimulants. In the evening, temperature was 37.6° C., pulse 72, pain in abdomen, and nausea. Restless during the night. During the next few days pulse became more frequent, jaundice and diarrhoea, great restlessness and collapse, which terminated in death on the sixth day after the operation. At the autopsy extensive purulent peritonitis was found to have been the cause of death. In the transverse mesocolon a hole was found, through which a fist could be passed. Through this opening a cavity, the size of a fist, was entered, the walls of which were infiltrated with blood and pus. In the bottom of this cavity the exposed pancreas was seen, which appeared divided transversely behind the head. Along the margin of the pancreas the splenic artery and vein were found ligated, and a portion of both vessels excised. The middle portion of the pancreas was absent. A portion of the tail of the organ, five centimetres in length, remained. Spleen enlarged to twice its normal size, otherwise normal in structure. Remaining organs healthy. A microscopical examination of the cyst showed that its walls contained pancreatic tissue. Inner surface not lined with epithelial cells.

CASE IV.—Reported by Kramer, operation performed by Hahn (*Centralblatt f. Chirurgie*, No. 2, 1885). Female, sixteen years of age, after an attack of vomiting and pain in the abdomen noticed a gradual distention of the upper portion of the abdominal cavity. The size of the tumor and the area of dullness corresponded to my case. The dullness appeared to be continuous with the hepatic dullness. Echinococcus cyst of the liver was diagnosed. Laparotomy was performed, and the omentum divided between the stomach and the transverse colon. About two litres of an albuminous fluid were removed by tapping. The cyst was stitched to the margin of the abdominal wound, incised and drained. The patient recovered with an external pancreatic fistula, which continued to secrete pancreatic juice for four months.

REMARKS.—The experiments made for the purpose of ascertaining the effect of complete and permanent obstruction of the pancreatic duct, as detailed in the first part of the paper, have demonstrated conclusively that obstruction is not the only nor the most important element in the causation of a pancreatic cyst. That the ligated portion of the pancreas continued to secrete pancreatic juice was proven by the experiments on external pancreatic fistulæ, and yet, of the many cases of ligation of the pancreas, in not a single instance was a cyst, or even an attempt at the

formation of a cyst, observed. The only physical evidence of obstruction was apparent in a moderate and uniform dilatation of the duct behind the ligature. The most important etiological factor in cases of cysts of the pancreas must be sought in an arrest of absorption of the pancreatic juice, due either to a transformation of the pancreatic juice by the admixture of pathological products into a substance which is incapable of being absorbed, or to a loss of function in this direction of the vessels which perform this task.

The obstruction in the pancreatic duct may cause retention and accumulation of pathological products, but can never be the sole cause of retention of pancreatic juice in an otherwise healthy portion of the pancreas. In the cases where normal pancreatic tissue was found in the cyst-walls, it was more than probable that the pathological condition which had caused the obstruction did not effect complete physiological detachment of the peripheral portion of the pancreas; in other words, the obstruction was not complete. In cases where complete physiological detachment has taken place, either by the application of a ligature, or complete obliteration of the duct by pathological conditions, parenchymatous degeneration and atrophy in the detached portion is such a constant result, that the exceptions to this rule must indeed be few, if any. In the diagnosis of pancreatic cysts nothing new has been added. The history of the case, the primary starting-point of the tumor in the epigastric region, its gradual and almost painless growth, are points which should be carefully considered in the differential diagnosis of abdominal cysts. The treatment by extirpation, as only recently practised again by Riedel and Billroth, is not deserving of imitation.

The post-mortem examination in Billroth's case shows only too plainly the difficulties met with in identifying the tissues at such great depth, and of avoiding unnecessary injury to important structures. I wish again to repeat what I had to say on this method of treatment last year. Extirpation of the cyst would guard most effectually against the formation of a permanent pancreatic fistula, but, on account of the deep location of the pancreas, shortness or absence of a pedicle, and the many obstacles thrown in the way of the operator by adjacent organs, the procedure becomes one surrounded by innumerable difficulties and, in the present state of our science, of doubtful propriety. The formation of an external pancreatic fistula in the treatment of cysts of the pancreas has been so uniformly successful that it should be invariably adopted in preference to excision, and the latter operation should only be resorted to in cases where portions of the cyst wall have become the seat of malignant disease, likewise in cases where life is threatened by hemorrhage into a cyst by rupture of vessels lining the interior of the cyst, and which cannot be controlled by simpler and less hazardous measures.

TUMORS OF THE PANCREAS.

Hypertrophy.

Störck (*Annus Medicus*, 1836, Schmidt's *Jahrbücher*, Supplement Band, 1836, p. 161) mentions a case of intestinal obstruction caused by hypertrophy of the pancreas.

CASE I.—A man, forty-eight years of age, previously in good health, had felt a sensation of weight and distress after meals, for more than six months. The flatulency also caused disturbance, and was relieved at times by drinking large quantities of water. Bowels constipated. The symptoms of obstruction developed gradually, but finally became so severe that nothing was retained on the stomach. After obstruction had become complete, the patient became collapsed and died two days later. At the autopsy no signs of inflammation or effusion in the peritoneal cavity could be found. Head of pancreas was found enlarged to the size of an orange, which had so completely compressed the duodenum that its lumen would only permit the passage of a goose quill. Pyloric portion of the stomach enormously dilated, so that this pouch resembled a kind of lesser stomach. The pancreas was softer, more succulent, and fleshier than normal, but not at all indurated.

REMARKS.—As no microscopical examination of the tumor was made, we are unable to classify this case, but considerable doubt must remain whether it was a case of tumor or simple hyperplasia of the gland. The age of the patient and the effect of the tumor upon the duodenum make it quite probable that it was not a case of hypertrophy but carcinoma. The case illustrates the fact that tumors of the pancreas, when they occupy the head of the organ, are liable to produce intestinal obstruction by compression.

Sarcoma.

Of the malignant tumors of the pancreas, carcinoma is of much greater frequency than sarcoma. Only a very few cases of primary sarcoma of the pancreas are on record.

CASE II.—Mayo (*Outlines of Human Pathology*, p. 411) mentions a case of primary sarcoma of the pancreas, with secondary invasion of the stomach, that came under his care. The patient, a man aged thirty-five years, died after an obscure illness which lasted eight months, during which time it was impossible to locate the disease. He dated his illness back to a febrile attack, which left him in a debilitated condition; and from that time he was liable to dyspeptic symptoms, with variable appetite and undefined uneasiness in the epigastric region. A high degree of anæmia was a conspicuous symptom during life. Although the appetite remained good, and digestion did not appear to be very much impaired, emaciation progressed rapidly. On inspection, all the internal parts were found remarkably pale, and void of blood; the heart healthy, but remarkably empty. The pylorus was thickened and firmer than usual, and had contracted adhesions to the pancreas. The pancreas was considerably enlarged and of nearly cartilaginous hardness, except some spots, which were soft, with the appearance of medullary sarcoma. No other disease could be detected in any other part of the body.

CASE III.—Lépine and Cornil ("Contribution à l'anatom. path. du pancréas," *Gaz. Méd. de Paris*, 1874, p. 624) examined the body of a man, sixty-two years of age, who had been sick for eleven months, and had suffered from obstinate vomiting for seven months. The head of the pancreas was found

very much enlarged; the remaining portion of it was normal. The small curvature of the stomach was adherent to the tumor, the pyloric orifice thickened and its lumen narrowed. The adhesions involved also the liver, diaphragm, and lower surface of the lung. White metastatic nodules were found in both kidneys. Under the microscope, section of the tumor revealed a sarcomatous structure.

REMARKS.—In the two cases related here we have the principal types of clinical behavior of sarcomatous tumors. In the first case the disease involved almost the entire organ, having given rise to extensive local destruction without metastasis; in the second case the disease was limited locally to the head of the pancreas, while it had extended early by contiguity to adjacent organs and by metastasis to distant organs.

Friedreich (Ziemssen's *Cyclopædia*, vol. viii. p. 614) claims that at present we are acquainted with only one reliable case of primary sarcoma of the pancreas. It is described by Paulicki, and was found to be of the small-celled variety; it was taken from the body of a young man who had died of pulmonary and intestinal phthisis. It had not given rise to any noticeable symptoms during life.

Carcinoma.

It is claimed by some pathologists that primary cancer of the pancreas is an exceedingly rare affection, and that in the majority of cases in which this organ is the seat of the lesion, it occurs as a secondary affection, having reached it by extension from an adjacent organ, especially from the pyloric extremity of the stomach. While this may be true in many cases, quite a number of specimens have been examined in which the disease occurred here as a primary affection. Suché ("De Scirrho pancreat. nonnula," Dissert. Berol., 1834) appears to have examined a specimen which affords a good illustration of primary cancer of the body of the pancreas. The middle of the gland was converted into a hard, irregular, nodulated mass, of the size of a fist, which rested directly upon the aorta, which imparted to it pulsation during life. When cut into, the tumor grated under the knife, and the cut surfaces presented a laminated appearance. The substance of the tumor was traversed by numerous large veins; both extremities of the pancreas were healthy, and no secondary nodules could be found in any portion of the body. A primary cancer of the pancreas is also described by Schupman (*Hufeland's Journal*, 1841), where the tumor had formed adhesions with the spleen, while the liver contained a number of metastatic deposits. The terminal extremity of the pancreatic duct contained a cylindrical calculus with a number of arborescent projections, which corresponded to the contributory ducts. In another case, reported by Récamier (*Rev. Méd.*, 1830), the cancerous tumor, which involved the tail of the pancreas, was connected with the left kidney and compressed the ureter. The right half of the pancreas was healthy, the diseased

portion gray, hard, and lardaceous. The pelvis of the left kidney, in consequence of the compression of the ureter, was hydronephrotic. The remaining organs were healthy.

Bright, in 1832, reported a number of cases of primary carcinoma of the pancreas, with a special view of illustrating the effect which disease of this organ would have upon the digestion of fat. In three out of eight cases he noticed fatty diarrhœa, and he was inclined to the belief that this symptom, when present, was almost pathognomonic of the existence of disease of the pancreas ("Cases and Observations Connected with Disease of the Pancreas," *Medico-Chirurgical Transactions*, vol. xviii. p. 1).

In all cases the fatty diarrhœa was associated with jaundice. The following post-mortem account (p. 17) leaves no doubt that the disease was primarily limited to the pancreas:

"The cause of the pressure on the bile-ducts was immediately obvious; for, on placing the hand near the pylorus, a hard lump, of the size of a common egg, was easily felt, and was soon discovered to be the head of the pancreas itself, and not the glands surrounding that part, forming a yellow mass like the boiled udder of a cow, almost cartilaginous in hardness. Its texture was uniformly hard and unyielding, and the whole pancreas partook of the same, but in a less degree. The head of the pancreas was firmly and inseparably glued to the duodenum, and the hardness very nearly surrounded the viscus."

As undoubted instances of primary cancer of the pancreas, we must mention the published cases of Muehry (*Casper's Wochenschr.*, No. 10, 1835), Albers (*Med. Correspbl. rhein. u. westf. Aerzte*, No. 8, 1843), Haldaure (*Assoc. Med. Journ.*, May, 1854), Webb (*Phila. Med. Times*, vol. ii., December, 1871), Gross (*Ibid.*, vol. ii., June, 1872), Luithlen (*Mem. a. d. aerztl. Praxis*, 1872, vol. xvii. p. 309), Roberts (*British Med. Journ.*, Sept. 1865), Wagner (*Archiv d. Heilk.*, vol. ii. p. 285), Bowditch (*Boston Med. and Surg. Journ.*, July, 1872), Davidsohn (*Ueber Krebs der Bauchspeicheldrüse*, Dissert. Berlin, 1872), Williams (*Med. Times and Gaz.*, August, 1852), and Frerichs (*Klin. d. Leberkrankheiten*, vol. i. pp. 146 and 153), as referred to by Friedreich ("Diseases of the Pancreas," *Ziemssen's Cyclopædia*, vol. viii. p. 608).

According to Da Costa (*North Am. Med. Chir. Review*, September, 1858), cancer of the pancreas is more frequent in the male than in the female, and in preference attacks people more than forty years of age. It usually appears as a firm tumor or scirrhus, with a well-developed connective tissue reticulum. Other varieties of carcinoma have been described. Thus, Wagner observed a cylindroma, and Lücke and Klebs have each met with the colloid variety. The primary starting-point is usually in the head of the organ, whence it extends in all directions. By extension within, it successively invades the body and tail of the organ, until the whole gland is involved, when it forms a nodulated spherical

tumor. The extension of the growth in an opposite direction soon reaches the duodenum, where it produces a narrowing or complete stenosis of that portion of the intestinal canal. A case of this kind is related by Hoelscher, in which the duodenum was constricted to such an extent that it was entirely impermeable, and the patient suffered for several days from symptoms of intestinal obstruction. While cancer of the stomach is liable to extend to the pancreas, the reverse is not frequently observed. When the carcinoma develops primarily in the pancreatic ducts, it belongs to the variety called cylindroma. The lymphatic glands in the vicinity of the pancreas are invariably affected during the later stages of the disease.

Steorrhœa is an important but not infallible symptom of cancer of the pancreas. It is attributed to an absence of the pancreatic juice from the intestinal canal, caused either by obstruction in the duct or suspension of the physiological function of the organ by the neoplastic infiltration. Epigastric pain is an early and important symptom, and is the result of compression of the cœliac plexus by the tumor. The pain often assumes a neuralgic character, and is usually not aggravated after taking food. Vomiting is a frequent symptom, and the matter ejected is generally a watery fluid, sometimes stained with bile. Constipation is an almost constant symptom. Progressive emaciation and anæmia attend malignant disease in any locality, but are unusually well marked in cancer of the pancreas. When the disease extends toward the duodenum, jaundice occurs from stenosis of the bile-ducts by compression or direct invasion by the neoplasm. Bruen has called attention to some forty cases of jaundice due to primary carcinoma of the head of the pancreas, lately reported by another observer, from which it is demonstrated that jaundice is an invariable symptom of primary scirrhus of the head of the pancreas, while it is uncommon when the disease is secondary, or affects the body or tail of the organ.

The most reliable evidence is the appearance of a tumor in the epigastrium behind the stomach. The difficulty of examining the pancreas during health by palpation is appreciated when a physical examination is to be relied upon in locating tumors in this locality. The normal pancreas can be felt only under the most favorable conditions through a thin and relaxed abdominal wall, but in determining its relative size this method of examination affords but little reliable information. A cancer of the pancreas, when it can be felt by palpation, appears in the epigastrium as a hard, immovable, or only slightly movable tumor, which is evidently deeply seated in the abdominal cavity. Under favorable conditions the connections of such a tumor with the pancreas can sometimes be demonstrated during life, but a positive diagnosis becomes impossible when, as in most of the cases hitherto recorded, it constitutes merely a part of a general tumefaction of the abdomen. As the tumor

is in such close proximity to the abdominal aorta the pulsations of this vessel are imparted to the tumor, and a bruit may even be heard over the compressed vessel; but, in contradistinction to aneurism, the pulsation is felt in only one direction, and the bruit disappears when the patient is placed in the knee-elbow position, as the tumor is lifted from the vessel by the force of gravitation.

That the tumor cannot be always felt is evident from the statement made by Da Costa that he recognized it in only 13 out of the 137 cases he reported; and Bigsby, in an analysis of 15 cases, alludes to its being recognized in only 4.

From what has been said, it will be seen how uncertain the symptoms are in the diagnosis of cancer of the pancreas. A satisfactory conclusion can be reached only after a careful consideration of the history of the case combined with a systematic elucidation of all the symptoms presented, and more particularly by resorting to the advantages to be derived from a systematic and careful study by exclusion.

A positive diagnosis of malignant disease of the pancreas is only possible after the tumor has attained sufficient size to be recognizable by palpation, consequently too late for a radical extirpation. When the disease has advanced to this stage it has already involved the greater portion of the gland and, as a rule, has invaded important adjacent organs. Another important element in the surgical treatment of cancer of the pancreas consists in the fact that the disease, as a rule, develops primarily in the head of the organ, a location which, in itself, precludes the propriety of an operation. The most favorable conditions for extirpation are presented if the disease is primarily located in the tail of the pancreas, and has not passed beyond the limits of the capsule of the gland. In such a case, excision of the splenic extremity of the pancreas would offer a fair prospect for a permanent result without endangering, as a remote consequence, the process of digestion, as a sufficient amount of secreting structure would remain in connection with the intestine to maintain pancreatic digestion.

Billroth, in two instances, made a partial resection of the pancreas in removing carcinomatous tumors of adjacent organs. In one case he removed a portion of the head of the pancreas with a cancer of the pylorus, and in another case he removed the tail of the pancreas with a sarcomatous spleen. Both patients recovered from the immediate effects of the operation. In the case of partial excision of the head of the pancreas it is to be assumed that the duct was not injured, that the organ continued to secrete, and the pancreatic juice was discharged into the duodenum through the uninjured duct. In operating upon the head of the pancreas for malignant disease which has extended to it from an adjacent organ, it is essential to preserve the continuity of the duct, so as to prevent physiological detachment of the remaining portion of the

gland, an accident which would be followed by degeneration and complete atrophy, consequently suspension of pancreatic digestion. If an operation is performed for cancer of an adjacent organ, and the disease has extended to the splenic extremity of the gland, the operation should not be completed without removing a sufficient portion of the pancreas to guard against a local recurrence of the disease in this organ. As in cases of partial excision of the pancreas for other lesions, the pancreas should be ligated before it is divided, so as to prevent troublesome hemorrhage, and at the same time guard against extravasation of pancreatic juice into the peritoneal cavity.

TUBERCULOSIS OF THE PANCREAS.

Primary tuberculosis of the pancreas is an exceedingly rare affection; indeed, some pathologists, among them Louis and Lebert, doubt its primary origin in this organ. Cruveilhier only mentions tubercular degeneration of the lymphatic glands upon the surface of the pancreas. In diffuse miliary tuberculosis of the abdominal organs Klebs could find no nodules in the substance of the pancreas on microscopical examination. But in such a condition the gland is often found in a state of parenchymatous degeneration which has been incorrectly interpreted as the first stage of tuberculosis by Ancelet.

When the lymphatic glands around the pancreas have undergone cheesy degeneration we sometimes find similar deposits in the pancreas, which, however, may be cheesy lymphatic glands in the substance of the pancreas itself. Hartmann mentions a case where the pancreas had disappeared completely and its place was occupied by a cheesy mass. Although the pancreas is not disposed to tuberculosis, we have reliable information that in a number of cases this gland was the primary seat of the process.

CASE I.—Reported by Aran (*Archiv gén. de Méd.*, 1846). The patient was a woman, twenty-five years of age, who died of a lingering disease. She had been sick for a year, during which time she felt exceedingly weak, had frequent attacks of vomiting, and the skin became deeply bronzed, in some places almost black. The pain, which was severe at times, was referred to the epigastrium. The necropsy showed a tubercular deposit in the tail of the pancreas the size of a hen's egg, surrounded by a zone of miliary deposits in the substance of the gland. Miliary tubercles were also found in the spleen.

CASE II.—Mayo (*Outlines of Human Pathology*, p. 410) describes a case where we have reason to believe that the process commenced primarily in the pancreas. The patient was an inmate of Middlesex Hospital, and was under the care of Dr. Wilson. He was thirty-eight years of age and had been ill for sixteen weeks; during the last seven weeks he was confined to his bed. The first symptoms were pain in the abdomen extending along the right hypochondrium to the spine. Twenty-eight days before death he became jaundiced, stools white, urine high colored; for some time he could lie on the right side only, and was often obliged to sit upright to draw breath. A large abdominal tumor had been felt immediately above the umbilicus some time before death, and the right arm and side of the neck had become œdematous.

Autopsy: serous effusion into the right pleural cavity. The gall-bladder was distended to a great size so as to contain eight ounces of fluid. The distention arose from an enlargement of the pancreas, the head of which formed an irregular sphere four inches in diameter, which had compressed the gall-duct; the rest of the gland was likewise enlarged. In parts it presented its natural texture and color, at other parts it was infiltrated with tubercular matter, which at two or three points had softened and formed thick pus. A few lymphatic glands, the thymus gland, and kidneys, appeared to be secondarily involved.

REMARKS.—Although in both of these cases the symptoms during life pointed to disease of the pancreas a sufficiently positive diagnosis to warrant a laparotomy could only have been made after a palpable tumor appeared, and after this time the disease had already passed beyond reach by the appearance of miliary deposits in other organs, an occurrence which would preclude the justifiability of any operative interference. Should abdominal section be performed in a case of tubercular peritonitis, and should such a condition in the pancreas be found as in Aran's case, it would be proper to extirpate the terminal end of the pancreas inclusive of the tubercular abscess.

In Wilson's case the tubercular deposit in the pancreas gave rise to a large abdominal tumor due partly to the distended gall-bladder, and as such a condition might present itself to the surgeon, in these days of diagnostical laparotomy, it might be advisable, and to the advantage of the patient to establish an external pancreatic fistula instead of closing the wound. Such a course would enable the surgeon to remove the cheesy material, disinfect the abscess cavity, and to treat its interior with iodoform, all of which, done under antiseptic precautions, would tend to modify favorably the local process.

The removal of compression of the bile-duct by the same procedure would also tend to reestablish the interrupted communication between the bile-ducts and the duodenum by removing the cause of the stenosis.

LIPOMATOSIS OF THE PANCREAS.

Lipomatosis, or fatty infiltration of the pancreas, is a pathological condition of this organ which is characterized by a transformation of the interacinous connective tissue into fat in contradistinction to fatty degeneration of the parenchyma cells, which sometimes occurs as an independent affection. In cases of fatty infiltration the shape and size of the pancreas may remain normal, but the secreting structures themselves may have completely disappeared by pressure atrophy. This disease is of little interest to the surgeon, except that it may serve as a predisposing cause of interstitial hemorrhage, in which connection it has already received mention; it is here again alluded to as a separate affection to demonstrate that gradual atrophy of the pancreas, even to the extent of complete disappearance of the glandular structures may occur without

causing serious impairment of the digestion. Rokitsansky (*Lehrbuch der path. Anat.*, vol. iii. pp. 313 and 369) has found this condition of the pancreas generally as a part and parcel of a general obesity, especially in intemperate persons, together with fatty liver, heart, and omentum. In the three cases of pancreatic apoplexy described by Zenker, the fatty infiltration of the pancreas was only one of the many evidences of a diffuse malnutrition of the tissues. In some of these cases the patients exhibited no symptoms during life indicating the absence of the pancreatic secretions, and yet, on making the post-mortem examinations, complete destruction of the glandular structure was found.

Litten has reported three cases of complete atrophy of the pancreas, in which, during life, no symptom of pancreatic disease was observed, such as fatty stools, salivation, lipuria, bronzed skin, celiac neuralgia, etc. (*Charité Annalen*, 1881). In two cases the atrophy was due to pressure, and in one instance it was caused by primary cancer of the pancreas.

In other cases the suspension of the pancreatic function by fatty degeneration of the organ produces well-marked symptoms during life, and may even result in death. Such a case is reported by Lépine and Cornil (*Gaz. Méd. de Paris*, p. 624). The patient was a drunkard, fifty-seven years of age. For six months he had been ailing with indigestion, marked loss of weight, diarrhoea alternating with constipation, no fever, no vomiting. For two months his body was covered with an eruption, and his feet became oedematous. At the autopsy the pancreas was found normal in size and shape, but the parenchyma of the gland had entirely disappeared, and its place was occupied by adipose tissue. The pancreatic ducts were filled with a viscid whitish fluid and small concretions. No other cause of death could be found in any of the remaining organs. Clinical observation appears to confirm the results obtained by experiments on animals, that in some instances complete gradual atrophy of the pancreas is compatible with normal digestion, while, in other cases, the suspension of the pancreatic secretion is followed by serious disturbance of digestion, marasmus, and death from inanition.

The only plausible explanation of the different effects of the same cause can be found in the supposition that in some individuals the compensating function of vicarious organs maintains normal digestion, while in others no such compensating action is established.

LITHIASIS OF PANCREATIC DUCTS.

Concretions of carbonate and phosphate of lime are frequently found in the pancreatic ducts. They are usually multiple, small, whitish, smooth, or of rough and irregular shape. Calculi in this locality have been found which measure more than an inch in diameter. In Shupmann's case, the calculus weighed 200 grains and measured one and a

half Paris inches in length, and from five to six Paris lines in diameter; having a crystalline surface, with processes running into smaller ducts. It was found in the left extremity of Wirsung's duct.

Sometimes the concretions of calcium phosphate and carbonate exist in incrustation of the mucous lining of the ducts. According to Collard de Martigny, the calculous concretion is sometimes composed of phosphate of lime alone. The calculi in this locality are usually solid formations, of fine granular structure with somewhat rough surfaces and very often covered with sharp points of projection. In some specimens the stone presents numerous branches which correspond to smaller pancreatic ducts. The irritation incident to the presence of a calculus in the pancreatic duct is followed by consecutive pathological changes in the duct and glandular tissue of the organ itself. The substance of the organ in the immediate vicinity of the stone becomes the seat of interstitial inflammation, followed by atrophy and sclerosis; the cicatricial tissue produced by this change causes contraction, an occurrence which may still further aggravate the obstruction. In most instances this inflammatory process does not remain localized but extends over the entire gland, as in the cases observed by Engel, Elliotson, and Curnow. In some cases the concretion gives rise to suppuration, as in Portal's case. His patient had died suddenly with symptoms of aneurism of the aorta, and at the autopsy an abscess was found in the head of the pancreas which contained a number of biliary and pancreatic calculi. In Fauconneau-Dufresné's case, as quoted by Ancelet, the left half of the pancreas contained a number of abscesses, one of which had perforated into the stomach. The pus contained numerous concretions from the size of a pin's head to that of a bean. Salmade observed a case of lithiasis complicated with abscess of the pancreas, where the swelling compressed the underlying aorta to such an extent, that death was produced by the rupturing of a vessel from overdilatation on the proximal side of the obstruction.

Mr. Moore (*Lancet*, Jan. 12, 1884) presented to the Pathological Society of London, the pancreas of a man, aged forty-three years, who died in St. Bartholomew's Hospital of an attack of pleurisy following gouty symptoms. The main duct of the organ was slightly dilated and contained a calculus of irregular shape, around which was a large abscess in the head of the organ. This abscess pressed upon the orifice of the bile-duct sufficiently to produce great distention of the gall-bladder. A number of cases of cysts of the pancreas have been reported in connection with a calculus in the duct on the proximal side of the cyst, and in which the dilatation of the duct was attributed to obstruction, due to the presence of the foreign body in the duct. Complete stenosis of the pancreatic duct, due to intrinsic or extrinsic causes, is always followed by parenchymatous degeneration of the glandular tissue on the peripheral side of the seat of obstruction, which necessarily arrests the physiological

function in that portion of the organ, hence we are unable to explain the retention of the secretion from this cause unless impaction of the calculus takes place suddenly. Again, assuming this to be the case, we know that healthy pancreatic tissue will remove its own secretion by absorption in case of sudden stenosis or obstruction of the duct. We are therefore forced to explain the occurrence of a pancreatic cyst in the course of gradual or sudden obstruction of the ducts by a calculus, cicatricial or malignant stenosis, to parenchymatous changes in the peripheral portion of the gland rather than to the obstruction. This argument, of course, applies only to the so-called retention cyst. Simple, uncomplicated obstruction of the duct may give rise to accumulation of pathological products which under no circumstances are amenable to removal by absorption. The former assertion is well illustrated by the specimen which Norman Moore (*Lancet*, Jan. 12, 1884) exhibited before the Pathological Society of London, which showed great dilatation of the common pancreatic duct throughout its entire length. Near the orifice the duct was obstructed by a small calculus of irregular shape. The whole gland was hard, and to the naked eye showed great connective tissue hyperplasia. The papilla in the duodenum was enlarged and the hardened tissue of the pancreas constricted the bile-duct so as to cause complete obstruction. The liver showed secondary changes due to the stasis of bile. A microscopical examination of the specimen showed it to be a case of genuine cirrhosis of the pancreas, only a small number of acini remaining in healthy condition. In this case the cirrhotic change in the organ was undoubtedly produced in the same manner as by constriction of the duct as practised in the experiments on animals, the first link in the chain of pathological changes being the mechanical obstruction of the duct by the calculus.

Positive diagnosis of pancreatic lithiasis during life is impossible. Calculi and concretions have been found at post-mortem examinations of persons who, during life, did not suffer from any symptoms indicating such conditions. Pain, fatty stools, hæmatemesis, diabetes, are symptoms sometimes associated with this lesion of the pancreas, but when present they point rather to the existence of a consecutive lesion of the substance of the gland produced by the calculus than to the presence of the calculus itself. If the calculus be arrested at the outlet of Wirsung's duct it may, at the same time, obstruct the outlet of the bile by compressing the ductus choledochus and so cause jaundice. But the same effect can also be produced by cirrhosis of the head of the pancreas, with or without the presence of a calculus in the pancreatic duct. Mr. Morris claims that he has seen cases of pancreatic stone colic, but in such cases it would be impossible to differentiate between the passage of a biliary and a pancreatic calculus along their respective ducts, as a biliary calculus may obstruct the common pancreatic duct and *vice versa*.

As the diagnosis of a calculus of the pancreas, *intra vitam*, is impossible, the surgical treatment must be limited to the management of some of its consecutive lesions—cysts, abscess, and retention of bile.

The treatment of cystic disease and abscess of the pancreas has been considered under their respective headings, and I will only add that when these conditions have been caused by an impacted calculus, an effort should be made to recognize the primary cause and, if possible, to remove it. As the surgical treatment of retention of bile due to the mechanical obstruction of the biliary passages is now receiving much attention, it is well, in this connection, to call the attention of surgeons to impaction of a pancreatic calculus in the duodenal portion of the pancreatic duct as an occasional cause of obstinate jaundice. If, in a case of this kind, abdominal section should reveal the true nature of the obstruction, an effort should be made at the time to force the calculus into the duodenum by taxis, and if this cannot be accomplished, the propriety of cutting for the stone should be carefully considered. As an impacted calculus in this locality not only endangers the life of the patient by cholæmia, but may also destroy life suddenly by perforation into the abdominal cavity, it would be not only justifiable but good treatment to remove it after a positive diagnosis has been made by means of diagnostic laparotomy. The greatest danger attending such a procedure would be extravasation of bile into the peritoneal cavity. This accident should be guarded against by removing the retained bile by aspirating the dilated bile-ducts as a preliminary measure. After extraction of the stone the incision in the duct should be accurately closed with fine silk sutures. The secretion of bile and pancreatic juice should be reduced to a minimum after the operation by keeping the digestive organs in a condition of absolute physiological rest during the time required for the healing of the visceral wound.

In conclusion I submit the following propositions:

1. Restoration of the continuity of the pancreatic duct does not take place after complete section of the pancreas.
2. Complete extirpation of the pancreas is invariably followed by death, produced either by the traumatism or gangrene of the duodenum.
3. Partial excision of the pancreas for injury or disease is a feasible and justifiable surgical procedure.
4. Complete obstruction of the pancreatic duct, uncomplicated by pathological conditions of the parenchyma of the organ, never results in the formation of a cyst.
5. In simple obstruction of the pancreatic duct, the pancreatic juice is removed by absorption.

6. Gradual atrophy of the pancreas from nutritive or degenerative changes of the secreting structure is not incompatible with health.

7. Physiological detachment of any portion of the pancreas is invariably followed by progressive degeneration and atrophy of the glandular tissue.

8. Extravasation of fresh normal pancreatic juice into the peritoneal cavity does not produce peritonitis, but is promptly removed by absorption.

9. Crushed or lacerated pancreatic tissue is removed by absorption, provided the site of operation remains aseptic.

10. Complete division of the pancreas by elastic constriction is never followed by restoration of interrupted anatomical continuities.

11. Limited detachment of the mesentery from the duodenum, as required in operations upon the pancreas, is not followed by gangrene of the bowel.

12. In all operations upon the head of the pancreas, the physiological connection of the peripheral portion of the gland should be maintained by preserving the integrity of the main pancreatic duct.

13. Partial excision of the splenic portion of the pancreas is indicated in cases of circumscribed abscess and malignant tumors, in all cases where the pathological product can be removed completely without danger of compromising pancreatic digestion or inflicting additional injury upon important adjacent organs.

14. Ligation of the pancreas at the point or points of section should precede extirpation as a prophylactic measure against troublesome hemorrhage and extravasation of pancreatic juice into the peritoneal cavity.

15. The formation of an external pancreatic fistula by abdominal section is indicated in the treatment of cysts, abscesses, gangrene, and hemorrhage of the pancreas due to local causes.

16. Abdominal section and lumbar drainage are indicated in cases of abscess or gangrene of the pancreas where it is found impossible to establish an anterior abdominal fistula.

17. Thorough drainage is indicated in cases of abscess and gangrene of the pancreas, with diffuse burrowing of pus in the retroperitoneal space.

18. Removal of an impacted pancreatic calculus in the duodenal extremity of the duct of Wirsung, by taxis or incision and extraction, should be practised in all cases where the common bile-duct is compressed or obstructed by the calculus and death is threatened by cholæmia.

19. In such cases the principal source of danger, extravasation of bile into the peritoneal cavity, should be avoided by preliminary aspiration of the dilated bile-ducts, accurate closure of the visceral wound with fine silk sutures, and absolute physiological rest of the organs of digestion during the time required in the healing of the visceral wound.

A SHORT ACCOUNT OF THE DISEASE CALLED "AINHUM,"
WITH THE REPORT OF A CASE.¹

BY FRANCIS J. SHEPHERD, M.D.,

PROFESSOR OF ANATOMY IN MCGILL UNIVERSITY; SURGEON TO THE MONTREAL GENERAL HOSPITAL.

It was my fortune, in the month of May last, to meet with a case of the rare disease called ainhum² at the Montreal General Hospital. So far as I know, it is the first case of the kind that has been met with in Canada. I am indebted to my house surgeon, Dr. H. S. Birkett, for the report of the case and the preparation of the specimen illustrating it.

CASE.—John B. S., æt. forty-seven, colored, native of North Carolina, and by occupation a teamster, was admitted into the Montreal General Hospital from Cornwall, Ontario, May 12, 1886, suffering from a painful toe which he wished to have removed.

History. Six years ago he noticed a small pimple on the outer side of the right little toe in the digito-plantar fold. He did not suffer any inconvenience or pain from the affection till four and a half years ago, when he noticed a constriction on pressure appearing in the digito-plantar fold. The foot was then slightly swollen and the toe was somewhat enlarged. With rest and poulticing the sore healed up and the pain and swelling of the foot disappeared, but the constriction remained and the toe continued enlarged. Four weeks ago the sore broke out again and the toe became very painful. The furrow, which had been increasing gradually, now rapidly deepened and the portion of toe beyond became much swollen and pained him greatly when he walked. Patient has always been healthy and lived in North Carolina till twenty years ago. No member of his family, to the best of his knowledge, ever had a similar affection of the toes.

Condition on entrance. Patient, a strong, healthy, full-blooded negro, complains of inability to walk much on account of the severe pain in the little toe of the right foot. Upon examination this toe is found to be very much constricted at the digito-plantar fold, the constriction almost completely encircling the toe—in fact, it looks as if a string had been tied tightly round it. The portion of toe beyond the furrow consists of a soft ovoid mass and is much larger than the normal toe. Nail quite healthy. The toe is very mobile and movement causes excessive pain. On the plantar aspect of the constriction is a small granulating sore which, on probing, is very sensitive. Foot not swollen. No other toe of either foot affected. Left little toe carefully examined and found perfectly normal.

On the 14th of May the toe was amputated at the metatarso-phalangeal joint, and the wound, under dry dressing and iodoform, rapidly healed.

On dissection the amputated toe appeared to consist of much thickened skin and fibrous tissue. Adipose tissue normal. The bones presented a remarkable condition. The proximal phalanx was much atrophied and

¹ Read before the Canada Medical Association, Quebec, August, 1886.

² This is the negro name for this affection. It means "to saw."

ended in a fine point, the whole bone looking something like a claw ; the joint between it and the middle phalanx had disappeared ; the middle phalanx was much reduced in size and eroded at its proximal end, no distinct articulation could be made out between it and the ungual phalanx. This latter phalanx, though of proper length, was excessively thin and light.



Showing the line of constriction and the condition of the three phalanges.

The metatarso-phalangeal joint was perfectly healthy, though the end of the phalanx entering into the joint was somewhat lessened in size and misshapen but the articular surface was of full size.

The disease called "ainhum" is one of great rarity ; it is peculiar to the dark races, not only to negroes, as was formerly supposed, for it occurs also in India among the native Hindoos. A very interesting report of four cases, by Dr. D. G. Crawford, of the Indian Medical Service, has lately appeared.¹ Dr. Crawford found that the disease was met with in about one out of every 2500 surgical cases treated at his Dispensary at Calcutta. In one of his cases the great toe was affected, in one the fourth toe, and in two the fifth toe. In no case was there any appearance of symmetry. The disease at one time was thought to attack the little toe only, but later observers have seen it in the fingers and even in the legs. It is said to occur in intrauterine life, and to be the most frequent cause of congenital amputation.² Only very few cases have thus far been reported in North America ; in South America, however, it is comparatively common in the African negroes, but rarer in those born in Brazil. It is said to be a common affection on the West coast of Africa.³ The disease was first clearly described by Dr. J. F. da Silva Lima, of Bahia, Brazil, in 1867.⁴ In the cases described by him the affection was confined to the little toes of adults, but lately

¹ Edinburgh Medical Journal, June, 1886.

² C. Stedman in Buck's Reference Handbook, vol. i, p. 91.

³ Dr. Rolf Leslie, who has lately returned from the Congo, where he spent two years, tells me that he never met with a case whilst there.

⁴ Gazeta Medica di Bahia, Anno I., No. 13, p. 146, quoted by H. Weber, Path. Soc. Trans., 1867, vol. xviii.

others have described it as occasionally being seen in children, and also, as mentioned above, affecting other toes, fingers, and even limbs.

Dr. Silva Lima found the disease to be more common in men than women; it is also said to be more prevalent in certain families, showing its hereditary, and, hence, constitutional nature. The only cases reported in North America are those by Drs. Hornaday and Pittman. In Dr. Hornaday's report of his case¹ he refers to one previously reported by Dr. N. J. Pittman, in 1880, to the North Carolina Medical Society. It was the first case Dr. Pittman had met with in a practice extending over forty-two years.

Dr. Hornaday's case occurred in a negress aged ten. It is curious that the man whose case is narrated above is a native of North Carolina.

As a rule, the affection commences as a furrow on the line of the digito-plantar fold of the little toe; this furrow gradually deepens, and the end of the toe enlarges to double or treble its normal size, having a spherical shape. Generally there is no pain, inflammation, or ulceration, but when there is ulceration in the furrow, as in my case, the pain is excessive.² As the furrow goes on deepening, it encircles the toe till the end is held by only a small pedicle. The toe does not lose its sensation, but from its great mobility it is subject to injury and painful knocks and the patient in consequence applies for relief. The toe is generally removed at the point of strangulation by knife or ligature. If left alone it falls off itself. The wound always heals rapidly. It is asserted that the disease can be arrested in the early stages by free longitudinal incisions cutting through the constricting fibres.

The course of the disease is very slow, lasting some eight to ten years. According to Silva Lima, the disease is usually asymmetrical, the affection in one toe being much further advanced than in the other. The phalanges atrophy and are replaced by fibrous tissue and the joints disappear. The skin is much thickened and there is great hypertrophy of the papillary layer; the bloodvessels are also thickened and become larger.³

The cause of the disease is not known. The fact that sensation is not lost distinguishes it from leprosy, as does, also, its localization. It is probable from the great atrophy of bone which takes place, that the disease is of nervous origin and is due to some trophic disturbance of the nerve centres. Microscopic sections of removed toes present no peculiar appearances; so much is this the case that when a report on a toe affected with "ainhum" was presented to the American Dermatological Society, in 1880, by a previously appointed committee, they suggested

¹ North Carolina Medical Journal, September, 1881.

² Dr. Crombie, Indian Medical Gazette, quoted by Dr. Crawford, in *Edin. Med. Journ.*, June, 1886.

³ Dr. H. Weber, *Path. Soc. Trans.*, 1867, vol. xviii. p. 279. In this article beautiful plates of microscopic sections are given.

the probability "that the constricting ring was produced artificially by tying a thin ligature round the toe which, if not continuously encircling it, was worn for long periods of time."¹ No doubt, if a portion of the removed toe were placed in the hands of a skilled bacteriologist an "ain-hum" bacillus would be found, which, when inoculated, would produce a similar disease in rabbits and mice. The experiments, of course, should not be performed with *white* mice or rabbits. I regret exceedingly that the soft parts of the toe removed by me were not preserved for purposes of investigation.

A CLINICAL STUDY OF CEREBRAL LOCALIZATION, ILLUSTRATED BY SEVEN CASES.

BY HENRY HUN, M.D.,

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DURING the past fifteen years great progress has been made in the study of cerebral localization, and it seems probable that in the immediate future the whole cerebral cortex will be mapped out into small areas; each being associated with a definite and distinct mode of mental action, depending on the peripheral connections of the nerve fibres which terminate in that particular area. A scientific basis for the theory of cerebral localization was obtained by Meynert from a study of the comparative and finer anatomy of the brain; and the wonderful advances made in our knowledge of cerebral anatomy by the researches of Meynert, Gudden, Flechsig, and others, have contributed largely to the perfection of this theory. More important, however, than anatomy in contributing facts in support of the theory of cerebral localization, have been the results obtained from experimental physiology, and from observations of disease in the human brain. Indeed, so large already is the accumulation of reported cases of cerebral disease which support the theory of cerebral localization, that the theory may in a general way be regarded as proved,² and it is desirable to publish only cases of such an unusual nature as will throw some light on the obscurity which still involves a great part of the subject. Such cases, it seems to me, are the following.

Of the seven cases here reported, one, Case II., was reported by Monakow in the *Archiv f. Psychiatrie*, the other cases are published now for the first time. I was present at the autopsies of Case I. and Case III.,

¹ Hyde, Diseases of the Skin, p. 421.

² For a most excellent article on the localization of cortical lesions of the brain, containing an abstract of all the American cases and references to similar collections of foreign cases, see M. Allen Starr, AMERICAN JOURNAL OF THE MEDICAL SCIENCES, vol. 87, pp. 65 and 366, and vol. 88, p. 114. Since Starr's article appeared a number of additional cases have been reported, notably a collection published by C. Günther in Zeitschrift f. klin. Med., vol. 9, p. 1.

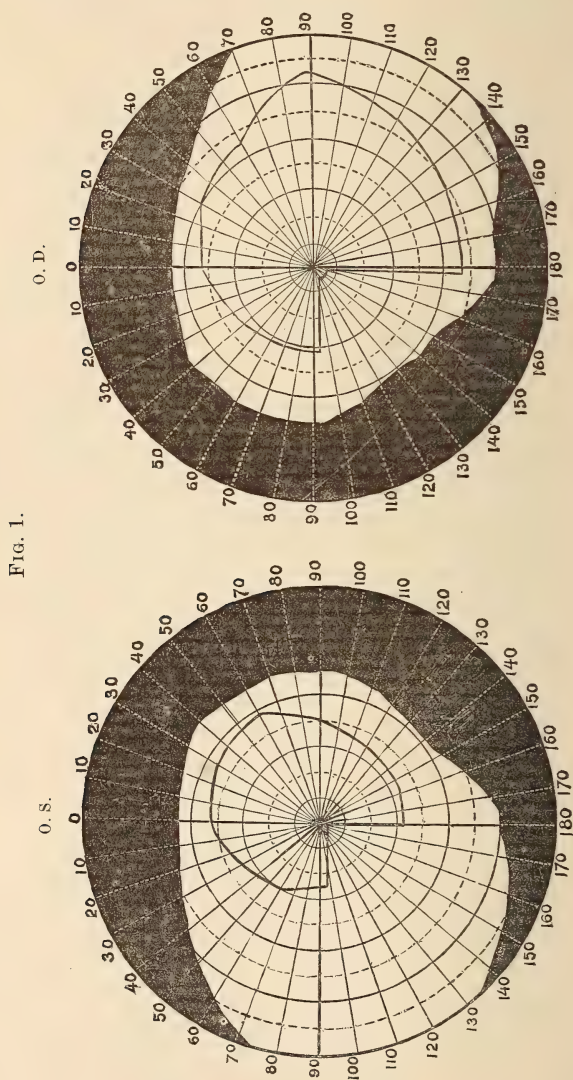
but not having seen the patients during their life, I was obliged to obtain the histories in part from the family of the patients, and in part from their physicians, Drs. Boyd and Merrill in Case I., Drs. Curtis and Van der Veer in Case III., who have kindly permitted me to publish the cases.

CASE I. *Defect in the fields of vision involving the lower left quadrant of each. Atrophy of the lower half of the right cuneus.*

May 20, 1886. H. M., male, æt. fifty-seven, married, of extremely nervous temperament. In 1869 he had a severe attack of double pneumonia, and during the year following he had slight attacks of vertigo while walking, which were attributed to weakness; with this exception he never suffered from any severe sickness. From 1877 until his death, he was troubled by slight deafness and by more or less roaring in his ears, which was especially constant and severe during the last two months of his life. In 1882 he had a large carbuncle on his neck, and after that time he seemed less vigorous than before. In 1884 he began to notice that when hurrying or walking up hill he was frequently compelled to stand still on account of precordial pain, and on June 23d of that year he had a very severe attack of pain in the cardiac region, extending into the left arm, and accompanied by extreme pallor, profuse perspiration, and the conviction that he was dying. On June 29th he got out of bed early in the morning, and while stooping to place a basket of silver outside of the bedroom door he complained of vertigo, seemed bewildered, and repeated over and over again questions as to the time of day, where he was, etc. He could not find the bed although standing near it, and begged to be led to it. At eight o'clock he arose to dress, but could not remember which article of clothing he ought first to put on; he dared not cross the room as all seemed dark before him, and "he was on the edge of an abyss." Everything seemed changed to him, nothing natural, even his breakfast of clam broth when brought to him he called cucumbers. After breakfast he slept soundly for several hours. He awoke with pain over his right eye, and during that day and the next this pain continued and his face was flushed and hot, but he seemed to have little or no trouble with vision.

During the next week he went out on the street a little each day, and on July 5th he went to a large hotel in the country. The fatigue of the journey and the confusion of the hotel seemed to bring back the mental confusion or disturbance of vision. At times he seemed puzzled; he could not tell how he had entered the dining-room, nor remember his table in it, nor find his bedroom alone. He was timid and conscious of his trouble, and would not be left alone for a moment lest he should lose his way. This confusion of vision or of mind gradually passed away, but his family noticed that he did not see a dish or plate which the waiter offered him on his left side, and he often told of narrow escapes that he had from being run over on the street. In November, 1884, he became very dejected, morose, and melancholy, especially on religious subjects; at other times he became greatly excited. Early in December he was examined by Dr. Merrill, who found normal reaction of pupils, normal appearance of fundus, vision and color perception perfect, a defect in the fields of vision involving almost the whole of the left lower and the peripheral portion of the left upper quadrants in each field.

The defect was somewhat more extensive, especially as regards the upper quadrant, in the left field of vision than in the right. The fields of



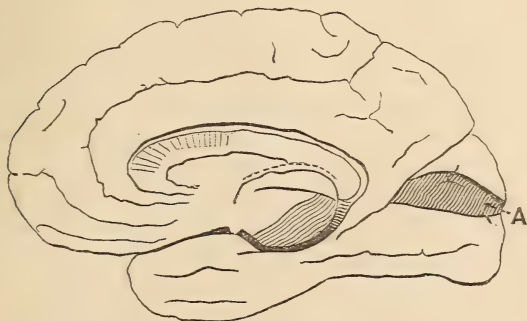
vision were carefully mapped out a number of times between December 3, 1884, and March, 1885, and always with the same result.

From this time the condition of the patient did not change materially. He continued to be very nervous and, at times, irritable and suspicious. He exhibited no paralysis of motion or sensation. He had little or no

pain in the head, except that once after writing much, which always was a great mental strain for him, he complained of pain behind the left ear, and said that he had with it strange hallucinations. His memory was weak in regard to names; he often called the same person by several names, in the course of a conversation; while in other respects, as in recognizing faces, it was excellent. He slept but little, and in his sleep there was much twitching of his limbs. In 1885 he had another severe attack of angina pectoris, and for two weeks afterward he could walk only a short distance without bringing on a return of the pain. In February, 1886, he had his most severe attack of angina, lasting several hours, and from this attack until his death he was scarcely a day without pain in the precordia or in the arm. During the last month of his life he vomited often, the vomiting being apparently unconnected with any gastric derangement. He complained of increased dulness of vision and of greater angle of obliteration, and was much troubled by a new building near by appearing to be out of line. On May 7, 1886, while quietly walking in the street he sank gently to the ground and died.

Autopsy held thirteen days after death and after the body had been embalmed, which greatly altered the appearance of the tissues. Body was in a good state of preservation and the tissues cut like leather. Skull-cap and dura mater presented no abnormal appearance. Moderate atheroma of the cerebral arteries. Slight dilatation of both lateral ventricles. At a point on the median surface of the right occipital lobe there was a complete atrophy of the cerebral convolutions, only a trace of them remaining as a delicate gray gelatinous fringe. This atrophy was strictly limited to the lower half of the cuneus; being bounded below by the calcarine fissure, in front by the parieto-occipital fissure, and above by a curved line which started from the parieto-occipital fissure and arching backward across the middle of the cuneus terminated at the posterior border of the median surface close to the calcarine fissure.

FIG. 2.



Median aspect of right hemisphere. (Ecker.)
A, point of attack.

The white matter underneath the point of atrophy was softened to a depth of about one-third of an inch. There was no deposit of pigment in the neighborhood. The corresponding point on the left occipital lobe showed no atrophy, nor did any of the other cerebral convolutions.

Sections through the brain substance, the optic thalami, and the other ganglia at the base revealed nothing abnormal. The optic nerves and tracts showed no macroscopic atrophy or degeneration. No microscopical examination was made.

The lesions found in the other organs were interstitial nephritis with cysts, moderate degree of atheroma of coronary arteries and of commencement of aorta. The wall of the left ventricle of the heart was very thin, without presenting any macroscopic increase of connective tissue, at a point near the middle of the posterior surface. No valvular lesion. General adhesive pleuritis. Patches of old cicatricial tissue, some of them calcified, were found at the apices of both lungs.

In this case there is a lesion which destroys the lower half of the right cuneus, and there is one constant symptom which is present during the whole course of the disease; a blindness limited to the lower left quadrant of the field of vision of each eye. In the absence of any other cerebral lesion the destruction of the lower half of the right cuneus must be regarded as the cause of the blindness in the lower left quadrant of each field of vision. Such a case as this, in which a homonymous *quadrant* of the fields of vision is lost and there is found as cause of it a limited cortical atrophy, has never been reported; and in order to understand its significance it is necessary to call to mind some well-established facts regarding the anatomy of the optic fibres.

That the cortex of the occipital lobes is the point of final termination of the nerve fibres which start from the retinae and is the perceptive centre for sight may be regarded as definitely established, since the experiments of Munk¹ have been, in part at least, confirmed by numerous cases of disease in the human brain. It is now universally considered that in the optic chiasm there is a partial decussation of the optic fibres of such a nature that fibres from the outer half of each retina pass directly backward to the optic tract of the same side, while the fibres from the inner half of each retina decussate in the chiasm and pass to the optic tract of the opposite side. Each optic tract is made up, therefore, in part of fibres from the retina of the eye of the same side and in greater part of fibres from the retina of the opposite eye; the ratio of the crossed to the uncrossed bundle being as 3 to 2. Consequently, while a destructive lesion of an optic nerve causes a blindness of one eye, a lesion of the optic fibres at any point in their course between the optic chiasm and the cortex of the occipital lobe causes a blindness limited to one-half of the field of vision of each eye. Such a condition of things is called a lateral homonymous hemianopsia,² and it may be produced by a lesion, either of one optic tract, or of the pulvinar of one optic thalamus, or of the posterior part of one internal capsule, or

¹ Ueber die Functionen der Grosshirnrinde, Berlin, 1881.

² Hemianopsia means a loss of one-half of the field of vision, hemiopia means a blindness of one-half of the retina; a right hemianopsia is, therefore, the same as a left hemiopia.

of the optic fasciculus as it passes backward from the internal capsule to the occipital lobe, or of the white matter of the occipital lobe, or of the cortex of the occipital lobe. A number of cases have been reported in which the lesion was confined more or less accurately to one or the other of these parts.¹ In all such cases when the lesion is situated on the left side of the brain the blindness is limited to the right half of each field of vision, and when the lesion is situated on the right side of the brain the blindness is limited to the left half of each field of vision. In many of the reported cases the hemianopsia is complicated by the presence of other nervous symptoms, which vary in character according to the situation of the lesion. When the lesion is confined either to the medullary substance or to the cortex of the occipital lobe, the symptom of hemianopsia is alone present and the reflex action of the pupil to light is normal. When the lesion involves the posterior part of the internal capsule the hemianopsia is associated with hemianæsthesia, and, if the lesion be extensive, with hemiplegia also. In this case also the reflex activity of the pupil to light is normal, whereas when the lesion is further down in the course of the optic fibres the reflex activity of the pupil to light is abolished or greatly impaired. When the lesion involves the pulvinar, the hemianopsia is frequently associated with hemianæsthesia and hemiplegia, because the lesion is usually not limited to the pulvinar but involves also the internal capsule. When the lesion involves the optic tract the hemianopsia is usually associated with hemiplegia and paralysis of some of the ocular muscles. Finally the hemianopsia sometimes occurs associated with aphasia, alexia, word blindness, and more or less complete hemiplegia and hemianæsthesia as a result of extensive occlusion of the cerebral arteries, especially of the left middle cerebral. These points and many others in regard to hemianopsia are well stated in an excellent paper in the *Journal of Nervous and Mental Diseases*, 1886, p. 1, and also in the *Archives de Neurologie*, 1886, i. p. 176, by Dr. E. C. Seguin, which is the most valuable article on the subject of hemianopsia with which I am acquainted.

Although in Case I. the blindness was, for the most part, limited to one-quarter of the field of vision, yet it must be classed for the present among the cases of hemianopsia or of hemiopic defect; because no class of tetartanopsia, to which it more properly belongs, is recognized. This case makes it probable that the fibres from the right upper quadrants of each retina terminate in the lower half of the right cuneus. It is true that not only the cortex of the lower half of the cuneus is completely atrophied, but also that the white matter immediately beneath it is the seat of softening. This focus of softening is, however, of little depth, and affects

¹ For a summary of the literature see Seguin, *Journal of Nervous and Mental Disease*, 1886, p. 1; Starr, *AMERICAN JOURNAL OF THE MEDICAL SCIENCES*, 1884, i. p. 65; Marchand, *Archiv für Ophthal.*, 1882, ii. p. 63.

principally the fibres running to the atrophied convolutions, and at most can involve only those fibres which run to the cortex in the immediate neighborhood of the atrophy. It may well be that this softening involving a few of the fibres running to the adjacent convolutions, causes the blindness in the peripheral portion of the left upper quadrant of each field of vision. So far then as this case shows anything in regard to the central termination of the optic fibres, it proves that the fibres from the upper right quadrant of each retina terminate in the lower half of the right cuneus.

Five cases have already been reported in which hemianopsia has been due to a lesion of the cuneus and of the adjacent part of the median occipito-temporal convolution;¹ so that it may now be considered definitely settled that in this portion of the cortex of the occipital lobe the fibres from homonymous halves of the retina have their final termination. Case I. not only supports this view but it carries the localization a step further, inasmuch as it shows that the fibres from the right upper quadrant of each retina terminate in the lower half of the right cuneus. The fibres from the right lower quadrant of each retina must, therefore, terminate either in the upper half of the right cuneus or in the right median occipito-temporal convolution. The cases of Seguin, Haab, and Heguinin can only be explained by this latter view; while the cases of Féré and Monakow can be interpreted either way. From an inspection of the plates in Seguin's article, which represent the cortical lesions that have been found in cases of hemianopsia, we are forced to the conclusion that *the fibres from the right upper quadrant of each retina have their final termination in the lower half of the right cuneus, and the fibres from the right lower quadrant of each retina terminate in the adjacent part of the right median occipito-temporal convolution.* Of course, the same relationship holds good between the left half of each retina and the left cuneus and left median occipito-temporal convolution.

If it be true that the optic fibres terminate in such a small portion of the occipital cortex, the question presents itself, What is the function of the remainder of the occipital cortex? That the cortex of the whole occipital lobe is the perceptive centre for sight, is shown not only by experiments on animals, but also by the fact that, in man, lesions of the occipital lobes, elsewhere than in the cuneus and median occipito-temporal convolution, cause disturbances of vision. It might be thought that, inasmuch as in most, if not in all, uncomplicated cases of hemian-

¹ Heguinin and Haab, *Klin. Monatsbl. f. Augenheilk.*, 1882, S. 141; Féré, *Archives de Neurologie*, 1885, I. 229; Monakow, *Archiv f. Psychiat. u. Nervenkrankh.*, 1885, S. 151; Seguin, *Journ. Nerv. and Ment. Disease*, 1856, p. 1. In a sixth case reported by Wilbrand (in *Gräfe's Archiv f. Ophthal.*, Bd. 31, S. 119), the lesion included this area but also extended beyond it, and in two cases, the one reported by Curschmann, and the other by Westphal, *Archiv f. Psychiat. u. Nervenkrankh.*, Bd. 11, S. 822, the lesion involved this region, but also involved the white matter beneath it to a considerable depth.

opia the central vision is intact, the very important fibres from the macula do not run to the cuneus or to the median occipito-temporal convolution, but have a wide connection with the rest of the occipital cortex. Such a supposition is immediately disproved by cases in which the lesion involved either an optic tract¹ or an entire occipital lobe,² and yet central vision was unimpaired; so that the fact that central vision is normal in cases of hemianopsia must be explained in some other way.³ The function, then, of the rest of the cortex of the occipital lobe must be sought in another direction, and in order to comprehend it, it is necessary to have clearly in mind the more important elements of a complete visual perception.

When the image of an external object is thrown upon the retina, nervous impulses are conducted along the optic fibres to their point of termination on the median surface of the occipital lobes, and give rise to a visual sensation and a very simple representation of the external object. The perception of the object is something different from this, and depends not only on nervous sensations originating in the retina, but also on feelings of innervation of the ocular muscles which are either taking place at the time of the perception, or by means of which in past time each point of the retina has become associated with a relative position in space. Another element in a complete visual perception is the binocular effect produced by a combination of the nervous impulses coming from each retina. The visual perception of an object is, therefore, distinct from, and much more complicated than, the visual sensation which is derived merely from the nervous impulses originating in the retina unassociated by education with other sensations. Such simple visual sensations occur alone only in babies or in blind persons to whom sight is suddenly restored; ordinarily the visual sensation is merged into and lost in the visual perception. Furthermore, every visual perception produces a permanent change in the occipital cortex, in consequence of which thereafter a memory of this perception is easily brought into consciousness. If the same object is seen again after a varying interval, the perception calls up more or less easily the memory of it, and the individual remembers that he has seen the same object before—he recognizes it. Every act of perception is almost inseparably connected with an act of recognition. It is very probable that the simple act of visual

¹ Hirschberg, Virchow's Archiv, Bd. 65, S. 116.

² Baumgarten, Centralbl. f. d. med. Wiss., 1878, S. 369.

³ In order to explain the normal central vision found in cases of uncomplicated hemianopsia, Schweigger (Gräfe's Archiv f. Ophthal., Bd. 22, S. 276) thought it possible that fibres from each macula lutea might be connected with both cerebral hemispheres. Mauthner (Vorträge a. d. gesamte Gebiet d. Augenheilk., Bd. 1, S. 360) states, however, that since in cases of hemianopsia one half of the macula lutea is intact, "upon this half of the macula images can be projected which are as sharply defined as ever, and, therefore, the persistence of normal central vision is not remarkable." Certainly, in such cases it requires but a very slight lateral movement of both eyes to throw the image on the healthy half of the macula.

sensation may be associated with cellular activity in a different part of the occipital cortex from that accompanying the complicated acts of perception and recognition, and it is, therefore, quite possible that a lesion of the median surface of the occipital lobe destroying the point of termination of the optic fibres might cause complete blindness in the corresponding halves of the retinae, and that a lesion of the convex surface of the occipital lobe might prevent full visual perception and might destroy all the memories of things that had been seen while simple visual sensation might be preserved.

In support of this view, and more especially on account of its great intrinsic interest, a very brief report is here introduced of a case of Monokow,¹ in which the symptoms were carefully observed, and in which the central nervous organs were examined with extreme care and exactness.

CASE II.—J. B., æt. seventy, an active, amiable, married man, with no hereditary taint. In 1878, he had several severe epistaxes, and soon afterward an apoplectic attack followed by a transient left hemiparesis, slight aphasia, hallucinations of sight and weakness of sight. These symptoms slowly disappeared and there remained only slight unsteadiness in walking, slight disturbance of sight, slight mental weakness and melancholia. In 1879, he had an epileptic attack, the convulsive movements being limited to the left side of the body, followed by a transient slight left hemiparesis, and the existing disturbance of vision (probably hemianopsia?) became more decided. He remained fairly well till January, 1882, when he complained that his sight was rapidly failing, although an ophthalmoscopic examination revealed nothing abnormal. In February, 1882, he had an apoplectic attack with transient left hemiparesis, blindness, hallucinations of sight, and disturbance of speech. Motility returned in a few days, but the disturbance of speech and an almost complete blindness remained. The patient, however, was no longer conscious of his blindness and did not even speak of dimness of vision, of which he complained in January. He often said that he was stupid, old, etc., but never that he was blind, although he thought that he was in a cellar and cried for light and fire. At other times he thought he was outside the house when he was really in it. During the last half year of his life the condition of the patient was substantially as follows: There was no disturbance of sensibility. The left hemiparesis was very slight. There was nothing abnormal about his speech except its irrelevancy due to his inability to understand spoken words. He heard noises and connected the proper associations with them. When, for example, the door was opened he asked who had entered. When he was spoken to he was conscious of it, listened attentively, and made answer, but his answer showed that he had not at all understood what was said to him. He understood only two words, "father" and "adieu." The patient had complete left hemianopsia. On the other hand, he saw things on his right side; he walked about the room without stumbling over the furniture; he found the door without difficulty and walked from one room into another; he found his bed and sat on it: but only when all these things were on his right side; to all things on his left side he was entirely blind. Although he saw things on his right side, more or less distinctly, yet he did not recognize them. He could not eat his food, though it was before him, and he was complaining of hunger; it was only when the food was placed in his hand and he felt it that he ate it greedily. Rapid and threatening movements of the fist toward his eye did not move him in the least. He could not recognize his wife except by the sense of touch. Often he called for his wife when she was by his side,

¹ Archiv f. Psychiat. u. Nervenkrankheiten, Bd. 16, S. 166.

and she was able to quiet him only by caresses and petting, and not by her voice, nor by standing in front of him, nor on his right side. He took interest in things about him, had a good memory, and correct judgment. He had hallucinations of sight and hearing but had no delusions, and was cleanly in his habits. In November he became drowsy, the drowsiness deepened into coma, and he died on December 17, 1882. From the very accurate and minute report of the examination of the brain I mention only those lesions which interest us in this connection. In the right hemisphere was found an almost complete atrophy of the cuneus, the median occipito-temporal, and the descending occipital convolutions; and associated with this atrophy was a degeneration and atrophy of the optic fasciculus, the pulvinar, the external geniculate body, and the optic tract, all of the right side and of both optic nerves. In the left hemisphere was found a great atrophy of the superior and middle temporal convolutions, a slight atrophy of the middle and inferior occipital convolutions, and a softening of the white matter beneath all of these convolutions. The lesion of the right hemisphere was of older date than that of the left.

In this case the lesion of the right occipital lobe caused a left-sided hemianopsia, and it is one of the cases which prove that the optic fibres from the right half of each retina terminate in the right cuneus and right median occipito-temporal convolution. The descending degeneration connecting these atrophied convolutions with each optic nerve also speaks strongly in favor of this anatomical connection. The lesion of the left occipital lobe did not involve these convolutions, and the patient saw things with the left half of each retina—*i. e.*, objects on his right side. Although, to a certain extent, he had visual sensation of objects situated on his right side, yet he did not perceive them fully or recognize them; not even recognizing his food or his relatives. This failure of complete intelligent perception must have been due to the lesion on the convex surface of the left occipital lobe, and, therefore, the cortex of the convex surface of the occipital lobe seems to be essential to the complete perception and recognition of things seen, just as the cortex of the temporal lobe is essential for the recognition of spoken words.

From this case, then, it seems probable that the cuneus and the median occipito-temporal convolution is the portion of the occipital lobe where the optic fibres terminate, and is the point for simple visual sensation; while the cortex of the convex surface of the occipital lobe is the point where the visual perceptions are completely elaborated and are fully recognized. That atrophy of the cortex of the occipital lobe will produce a condition of consciousness in which things are seen to a certain extent, but are not completely recognized and understood, appears probable from those not very rare cases of progressive paralytic dementia in which, especially after apoplectiform attacks, the patient sees but does not understand what he sees.¹ Such cases have also been reported as occurring in sane persons.² Very few cases have been reported in which

¹ Fürstner, Archiv für Psychiatrie und Nervenkrankheiten, Bd. 8, S. 162, und Bd. 9, S. 90. Stenger, Archiv für Psychiatrie und Nervenkrankheiten, Bd. 13, S. 218.

² Wilbrand, Ueber Hemianopsie.

the lesion has been strictly limited to the cortex on the convex surface of the occipital lobes, so that it is impossible yet to be certain whether such lesions cause only a loss of full perception and recognition while a certain amount of simple visual sensation remains, as in the case of Monokow; or whether there is a complete hemianopsia, as in a case (which I have not had an opportunity to read in the original) reported by Westphal,¹ but the former view seems the more probable. Whether, as is the case in both motor and sensory aphasia, the left occipital lobe is more important than the right as a centre for full visual perception, cannot as yet be decided.

From the study of hemianopsia thus far made, the following deductions may be drawn:

1st. The optic fibres from the right upper quadrant of each retina terminate in the lower half of the right cuneus.

2d. The optic fibres from the right lower quadrant of each retina terminate in the adjacent part of the right median occipito-temporal convolution.

3d. The lower half of the cuneus and the adjacent part of the median occipito-temporal convolution is the point of termination of the optic fibres from the homonymous halves of the retina; the right half of each retina being represented in the right occipital lobe, and the left half in the left lobe.

4th. On the median surface of the occipital lobe take place those actions which are associated with simple visual sensations.

5th. On the convex surface of the (left?) occipital lobe take place those actions which are associated with complete visual perception and recognition.

Before dismissing Case I. from our consideration, there remain one or two points worthy of mention. The mental disturbance due to the failure of the patient to recognize familiar objects, which characterized the commencement of the attack, was due probably not so much to the lesion of the cuneus as to the disturbance in the circulation in the adjoining portions of the brain, especially in the rest of the cortex of the right occipital lobe, and to a less degree in the left occipital lobe also. The recurrence, seven or eight days later, of this failure to recognize objects may be explained either by his being placed in strange surroundings, or, more probably, by the circulatory disturbances taking place in the occipital lobe consequent upon the reactive inflammation surrounding the point of softening. The attacks of angina pectoris were probably due to the atrophy of the ventricular wall at or about the middle of its posterior surface, which atrophy, very likely, resembled the cortical atrophy in that it depended on embolism, or thrombosis.

¹ Charité Annalen, 1882, p. 466.

Case II., besides being of great value in connection with the subject of hemianopsia, is also of interest in that it shows that an atrophy of the superior and middle temporal convolutions on the left side of the brain causes an inability to understand spoken words, although sounds are still heard. As a consequence of this inability to understand spoken words, the symptoms of sensory aphasia occur—*i. e.*, the patient, not understanding what is said to him, makes irrelevant remarks, and if by any chance in speaking he uses the wrong word, he cannot correct himself by the sense of hearing. Many cases have now been reported in which the inability to understand spoken words and the consequent sensory aphasia have depended on a lesion of the superior, or of the superior and the middle temporal convolutions on the left side;¹ so that we may justly conclude that the memory of spoken words depends upon the integrity of the left superior temporal convolution, and that the full perception and recognition of spoken words are associated with actions taking place in that portion of the cortex. In what portion of the temporal lobe the fibres of the auditory nerve actually terminate is not known, but that they must do so at some point other than the superior and middle convolutions is evident from the fact that when the whole temporal lobe, or the bundle of fibres which runs from the internal capsule to the temporal lobe is destroyed, there results not merely inability to understand spoken words, but complete deafness.²

CASE III. *Impairment of motion and sensation in right arm and leg; agraphia, alexia, and aphasia. Atrophy of lower three-quarters of posterior central convolution, and of the inferior parietal lobule of the left cerebral hemisphere.*

March 11, 1886. R. B., male, æt. sixty-six, married, lumber merchant. With the exception of an attack of pleurisy, when quite a young man, he has always enjoyed good health. He has been active and has devoted himself to business. On September 9, 1876, he was taken sick with typhoid fever, which lasted nearly six weeks, and was of moderate severity, his temperature never rising above 103° F. In the third week of this fever his family noticed one afternoon that he had suddenly lost his power of rational speech and could not make himself understood. On the arrival of the attending physician it was found that the patient had a right hemiplegia and aphasia. For some time after this the patient was slightly delirious and complained of some extra legs in bed with him, etc. After the fever ceased he remained much prostrated for a long time, and went down stairs for the first time in February, 1877. The paralysis of the right side of the body, especially of the arm, continued, and he had well-marked aphasia. Frequently at table he asked for a chicken when he wanted an egg, etc. He always knew in such cases that he had used the wrong word and recognized the right word as soon as he heard it.

¹ Seppilli, *Revist. Speriment. d. freniatre, etc.*, 1884, x. p. 94. Amidon, *New York Med. Journal*, vol. 41, pp. 113, 181.

² Wernicke und Friedländer, *Fortschritte d. Med.*, 1883, No. 6; also the case of Hutin cited in Wernicke's *Lehrbuch der Gehirnkrankheiten*, Bd. 2, S. 180.

On July 6, 1877, he was examined by Dr. Clymer, of New York, who found: "Right hemiplegia and aphasia. In right lower limb motor power fair, sensibility impaired and perverted. In right upper extremity motor power fair in arm and forearm, but motility of hand impaired; sensibility impaired and perverted, particularly in hand; sensations retained for some minutes after impact. There is a decided tendency toward contracture in the muscles of the right hand." Dr. Clymer also states in this letter that "there is probably an irritative process going on in the brain from the symptoms complained of." On October 25, 1877, Dr. Clymer examined him again and wrote: "I found him no worse and, I think, in some respects better. He drops fewer words and uses his words more correctly. He has, he tells me, less confusion. He says he does not get strong, and there is no improvement in his right arm. His mouth, too, is badly cankered." On December 7, 1877, Dr. Clymer wrote: Mr. B. has gained in the five weeks between his visits to me very much."

In the year 1878, the patient improved steadily. He walked without limping. He was able to use his right hand in cutting his food, in eating, etc., although it was awkward. He was able to dress himself and to take care of himself, but whenever he could he used the left hand in preference to the right. But the difficulty with the right hand seemed to be awkwardness rather than weakness. He complained that his hand felt numb, and he kept rubbing and working it almost constantly. The aphasia almost entirely disappeared, so that he resumed business and travelled about a good deal and had very little difficulty in expressing himself, especially when he was interested in what he was saying and was a little excited. His principal trouble, and the one which did not improve at all, was that he could not spell, read, or write. He could not spell the simplest word, such as "cat," from memory. There was a sign opposite his house on which was the name John Kingsbury. Many times a day he would look at the sign and spell out the name, J-o-h-n K-i-n-g-s-b-u-r-y. The John he almost always got correctly, but it was rather the exception when he read all the letters of Kingsbury without a mistake. After having spelled the name John by reading it many times, he would shut his eyes and try in vain to spell from memory the name John which he had just spelled by reading it. He was entirely unable to read. He might read one, or perhaps two words correctly, but could go no further. He understood perfectly whatever was said to him. He never learned to write with his left hand. He could sign his name with his right hand if he went at it with a rush, and everything went smoothly, but if by any chance he was stopped in the middle of the name he could not finish it, not knowing what letter came next. If the next letter were told him, he might, perhaps, finish the signature. He was able to write a little if some one told him the letters of most of the words. The following are fac-similes of parts of about the only two letters that he wrote during his sickness. He frequently complained of a "dull, bad feeling in his head." At times his mind seemed clear, but at other times he seemed dull and could not clearly comprehend some simple business transaction. At one time for several months he was very despondent, and thought that he had no money and must go to the poor-house. Before his sickness he was subject to sick headaches, but they did not trouble him much during his sickness. Toward the end of the year 1878, he had a severe attack of

I was to your
 office this afternoon
 to see you to
 wish me to go
 to Bluckers Tavern
 for hunting and
 driving as it is
 good weather
 for you

I cannot think
 how to make
 letters will
 I ever be able
 to understand
 or ever will
 you will see
 that I cannot
 compose words

gall-stones which confined him to bed for several months; gall-stones being found in the feces. Subsequently he had several milder attacks. He remained pretty well till 1881, when his son died; after that time he was somewhat worse. In the summer of 1884, one very hot day, he probably had a slight sunstroke, and after that he was decidedly worse and steadily failed. His leg dragged in walking and his arm became almost useless. His mind became a little dull. He found great difficulty in expressing himself, and would work a whole day trying to frame a sentence before he could get it right and express his meaning. His articulation was distinct and he rarely showed any mental irritability.

Autopsy held forty-one hours after death. The skull-cap was rather abnormally thick and the dura mater, which presented a slightly yellowish tint at points but was otherwise normal, was excessively adherent to it. The sinuses and vessels of the pia mater contained only a small quantity of blood. The pia mater presented numerous patches of opacity following the course of the vessels, and over the whole surface of the left hemisphere there was an increased amount of sub-arachnoid fluid. This effusion was especially marked at a point a little posterior to and above the posterior termination of the fissure of Sylvius where it formed a large fluctuating bag which resembled a mass of jelly. There was a slight atrophy of all the convolutions of the left hemisphere, and beneath the point of greatest effusion mentioned above there was almost complete atrophy of the convolutions, which were represented by a thin gray fringe resembling a fold of pia mater. This atrophy involved the whole of the posterior central convolution, except a small portion of it near to the superior longitudinal fissure, the adjoining part of the superior

FIG. 3.



Outer aspect of left hemisphere. (Ecker.)

A, point of atrophy.

N. B.—It is to be remembered that these charts of Ecker are schematic. In this case, although the lesion is mapped out according to the convolutions affected, yet the lesion appears decidedly larger as represented on the chart than the actual lesion was on the surface of the brain.

parietal lobule, and the whole of the inferior parietal lobule, comprising the supramarginal convolution and almost the whole of the angular con-

volution. The fissure of Sylvius thus seemed to extend directly backward to the occipital lobe. The area of this atrophy corresponded with the area of distribution of the third (ascending parietal) and fourth (parieto-sphenoidal) branches of the middle cerebral or Sylvian artery. The white matter beneath the atrophied convolutions was neither softened nor atrophied.

The convolutions of the island of Reil, the left inferior frontal convolution, and the white matter immediately beneath it, were entirely normal, as were, also, the convolutions of the right hemisphere. The arteries at the base of the brain, and even some of the smaller cerebral arteries, presented an extreme degree of atheromatous degeneration. The posterior communicating arteries were obliterated and resembled threads. The ventricles of the brain were normal, and no abnormal appearance was found on sections through the cerebral substance and the ganglia at the base of the brain. No descending degeneration could be discovered on macroscopic examination. No microscopic examination of the nervous tissue was made.

The other lesions found were hypertrophy and fatty degeneration of heart, thickening of mitral and aortic valves, atheroma of aorta, old double adhesive pleuritis, firm adhesions of colon to under surface of liver enclosing the gall-bladder, which presented the cicatrix of a healed perforation into the colon, and a moderate degree of interstitial nephritis in both kidneys.

The atrophy of the convolutions in this case and the attendant symptoms were evidently due to an embolism or thrombosis of the terminal portion of the left middle cerebral artery, which occurred in the third week of the typhoid fever.¹

In this case the principal symptoms are impairment of motion and sensation in right arm and leg, alexia, agraphia, and aphasia; and the principal convolutions involved in the atrophy are the posterior central, except a small portion of it near the longitudinal fissure, the supramarginal convolution, and the greater part of the angular convolution on the left cerebral hemisphere. The lesion differs greatly from that in Case I. in that it is so extensive, and it is possible to explain the numerous symptoms which this extensive lesion produced only in the light of other cases of cerebral disease.

In the first place, the case is of interest in a negative way inasmuch as it shows that this extensive lesion caused no disturbance of sight or hearing. From Case II. we learned that the memories of things seen depended on the integrity of the convex surface of the left occipital lobe, and that the memories of spoken words depended on the integrity of the left superior temporal convolution. Case III. shows that these centres cannot encroach to any extent on the parietal lobe, as it is sometimes claimed that they do. It is, also, one of the already some-

¹ Cases of recovery from probable occlusion of the middle cerebral artery occurring in the course of typhoid fever have been reported by Vulpian in the *Revue de Médecine*, 1884, p. 162; and Kühn in *Deutsches Archiv f. klin. Med.*, Bd. 34, S. 56.

what numerous cases which show that the cortical centre for sight is not situated in the angular convolution, as Ferrier concluded it was from his experiments on apes.

The most striking and persistent symptom in this case is the inability of the patient to read or write, or the alexia and agraphia, as these disturbances are respectively called. Neither the alexia nor the agraphia was complete. The patient could read single letters and even short words with difficulty, but he could not spell the word with his eyes shut immediately after having read it. He could not store up the memory of the word that he had just seen, although he could store up the memory of the same word when he heard it spoken. He could not remember the appearance of words. Both the alexia and agraphia of the patient can be easily explained on the supposition that he had lost the memory of the appearance of words. When he saw a word in reading he had no already existing memory with which to compare it and he was unable, therefore, to recognize it. When he tried to write he had no memory of the appearance of the letter or word which he wished to write, and, hence, he was unable to reproduce it on paper; as he said in one of the only two letters which he wrote during his illness, "I cannot think how to make letters." The agraphia did not depend on the motor disturbance of the right hand, for in his letter of March 20 the letters were written legibly enough, and subsequently the awkwardness of his arm became much less.

When we consider the act of reading, and especially when we consider how a child first learns to read, it seems natural that the cortical centre for reading, or that portion of the cortex on the functional activity of which depends the memory of the appearance of written or printed words, should lie near the auditory centre and especially near the visual centre; and such is indeed the case. For in the cases of alexia and agraphia in which an autopsy has been made, the lesion has involved the angular convolution.¹ In this case, therefore, we must consider the cause of the alexia and agraphia to be the atrophy of the angular convolution of the left hemisphere, and since this atrophy did not involve the entire convolution, the alexia and agraphia were not complete although nearly so.

Another constant symptom in this case is a disturbance in the motility or an awkwardness of the right arm, and, to a less extent, of the right leg. The lesion corresponding to this disturbance must lie in the so-called motor zone, which is the portion of the cerebral cortex that has been studied with special care. As a result of extended experimental and clinical study, it may be considered established that the two central

¹ M. Allen Starr, *AMERICAN JOURNAL OF THE MEDICAL SCIENCES*, vol. 87, p. 389. A. B. Ball, *Archives of Medicine*, 1881, vol. 5, p. 136.

convolutions and the adjacent part of the cortex are the cortical centres for movements of the opposite side of the body. The centre for the leg includes the paracentral lobule, the upper third of the two central convolutions, and the greater part of the superior parietal lobule. The centre for the arm includes the posterior part of the superior frontal convolution, the middle third of the two central convolutions, and the anterior part of the inferior parietal lobule. The centre for the face includes the lower part of the central convolutions, especially the anterior one. These different centres are not sharply defined from each other; the one merges into the other; and it is rare to find a cortical lesion so situated and so small that it produces a paresis or paralysis of only one extremity or of only one-half of the face. In Case III. the lesion involves a large part of the centre for the arm, and a small part of the centre for the leg, and consequently there is much impairment of the motility of the arm and a slight impairment of that of the leg. There is no distinct statement concerning the face made in the history, although the lesion seems to involve a portion of the centre for the face.

When we examine the motor disturbance of the arm more closely, we find that it consisted in awkwardness rather than weakness, and that it was confined more particularly to the hand and fingers, or to that part of the arm with which those fine and delicate movements are executed which are the result of much education. Complicated movements which he had formerly executed easily, the patient executed with difficulty. When he tried to write he said: "I cannot think how to make the letters," and in the same way, when he tried to use his hand in other acts, he probably could not think how to make the movement. He had lost his skill in using his hand. He had forgotten the necessary feelings of muscular innervation; the memory of former innervation feelings was destroyed. In order to understand this clearly it must be remembered that one of the most important functions of the cerebral cortex is the reproduction of former perceptions in the form of memories. The cortex of the so-called motor centres is essential for the reproduction of memories of muscular innervation for movements which have previously been performed, and which can be performed again easily and readily only by the aid of the corresponding innervation memories. These memories of muscular innervation have been originally acquired, in part at least, through reflex acts.¹

The lesion in Case III. involved only the posterior half of the centre for the arm, and the symptoms produced were those of awkwardness rather than weakness. From a consideration of the reported cases of lesions of the motor centres, it seems that lesions situated in front of the

¹ Meynert, *Psychiatry*, transl. by Sachs, vol. 1, p. 160.

fissure of Rolando cause a more complete paralysis,¹ and are more often associated with descending degeneration, than lesions situated behind the fissure of Rolando, which produce rather a paresis or awkwardness.² It seems probable, then, that the nerve fibres for the arm and leg have their origin in that part of their respective centres which is situated in front of the fissure of Rolando, (in the case of the arm the fibres probably start from the base of the superior frontal convolution), while that portion of the centre situated behind the fissure of Rolando is essential to the production of the memories of innervation feelings.

The aphasia which was present in the early part of this case, but which later almost completely disappeared, was not due to any lesion of the left inferior frontal convolution, which is the portion of the cortex now generally regarded as essential to the production of memories of the innervation processes necessary to the pronunciation of words and hence of speech. This is one of the not very rare cases of aphasia due to a lesion which causes an interruption in the conduction along the association fibres which connect the left inferior frontal convolution either with the temporal lobe or with the angular convolution—*i. e.*, with the cortical centres for the memory of either spoken or written words. A number of cases of aphasia dependent on lesion of the supramarginal convolution or of the white matter just below it have been published.³ Since in this case the aphasia was temporary, it was probably due to some temporary cause, as, for instance, anæmia of the conducting fibres in the white matter beneath the supramarginal convolution, which anæmia gradually disappeared as the collateral circulation became more or less perfect. It is quite possible, too, that the aphasia was in part due to the loss of memory of the appearance of words. In the case of Cornil cited by Wernicke⁴ a small lesion of the supramarginal convolution caused not only aphasia, but also hemianæsthesia; so that it might be inferred that the impairment of sensibility noted by Dr. Clymer in Case III. was due to the lesion of the supramarginal convolution. Such an inference, however, is unnecessary, for it is now well known that lesion of the so-called motor zone causes loss of sensibility, although it is not yet settled whether the cortical centre for cutaneous and muscular sensibility is limited to the motor zone or whether it includes also the parietal lobe.

From the above considerations it is evident that although in Case III.

¹ Mickle, *Journal of Mental Sciences*, April, 1885; Hirschfelder, *Pacific Med. and Surg. Journ.*, Oct. 1881; Spitz, *Deutsche med. Wochenschr.*, April, 1882; Prévost and Cotard, *Obs. 15 in Études physiol. et pathol. sur le ramolis. Cérébrale*, Paris, 1886.

² J. Hughlings Jackson, *Brain*, Oct. 1882; H. B. Sands, *Med. News*, April, 1883; Wm. Carson, *Am. Practitioner*, vol. xv. p. 217; Vetter, *Deutsches Archiv f. klin. Med.*, Bd. 22, p. 421.

³ Broadbent, *Medico-Chirurgical Trans.*, vols. lv. and lxi; S. West, *Brit. Med. Journ.*, 1885, p. 1242; Cornil, *Gaz. Méd.*, 1864, p. 534.

⁴ *Lehrbuch der Gehirnkrankheiten*, vol. ii. p. 176.

the lesion is very extensive, yet it confirms the following deductions which can be drawn from reported cases in which the lesion was less extensive :

1st. In the anterior part of the cortical centre for the arm originate the nerve fibres for the arm, and lesions of this part cause absolute paralysis.

2d. In the posterior part of the cortical centre for the arm take place those cellular actions which are essential to the production of memories of muscular innervation, and lesions of this part cause awkward, uneducated movements.

3d. The cortical centre for muscular and cutaneous sensibility extends over the motor zone and probably over the parietal lobe also.

4th. The left angular convolution is essential for the memory of the appearance of words and lesions of it cause alexia and agraphia.

The subject of aphasia will be considered later.

In Case III. the lesion affected principally the cortical centre for the arm, while in the following case the cortical centre for the leg was alone affected.

CASE IV. Left hemiparesis. Convulsions limited to the left side of the body always commencing in the left leg. Endothelioma pressing on right superior parietal lobule.

M. C., female, æt. forty-two, married, a servant, entered St. Peters Hospital June 7, 1883. Family history unknown. Patient has never been very strong, but has worked hard. Four and a half years ago she slipped and fell on the sidewalk, striking on the back of her head. About three and a half years ago she had the first of a series of attacks of which she has had about a half dozen in all. These fully developed attacks commence with a tingling and twitching of the left foot which gradually extend up the leg and then commence in the left arm; next the tingling sensation creeps up the back to the left side of the head, and the head commences to twitch; after the head has continued twitching for from ten to fifteen minutes and while the whole left side of the body is twitching she loses consciousness and remains unconscious for a quarter of an hour or longer; while unconscious she frequently has involuntary micturition. The right side of the body has never taken part in these convulsions. She has never bitten her tongue, and she has never had a convulsion which did not commence in the left foot. Besides these half dozen fully developed attacks she has had more frequently attacks in which she feels a pain in the left heel, the left great toe works up and down for a long time, and sometimes the muscles of the leg twitch, but the twitching goes no further and the attack passes off. Patient also complains that the left arm and leg are much weaker than the right and that she has much darting pain in the left leg, arm, face, and left side of head. She often feels as if a strap were drawn firmly about portions of the left arm and leg, and at times it feels as if her toes had fallen off; while it feels at other times as if her teeth had fallen out. These latter sensations are most marked immediately after an attack of convulsions. She says that her eyes are so weak that

she cannot read and that she has flashes of light before her eyes which make her dizzy. She complains of fulness and pain in vertex of head, and thinks that at times she is not in her right mind.

On entrance into the hospital patient seems weak and anæmic. An examination of the thorax and abdomen reveals nothing abnormal. Sensibility intact over both sides of face, both arms, and right leg. Sensibility in left foot and leg is somewhat blunted to tactile impressions but not to painful ones. Left leg is much weaker than right, so that she is unable to walk without a cane. Left arm is weaker than right. Grasp of right hand 50, of left 40, as registered on the outer circle of Mathieu dynamometer. Ankle clonus and exaggerated knee-jerk on both sides, especially on the left. No exaggeration of tendon reflexes in arms. Pupils equal and react to light. An ophthalmoscopic examination by Dr. Merrill reveals a typical specimen of choked disk. In both eyes the veins are tortuous, the disk reddened and œdematous. In the left eye there is rather less œdema, but there is a patch of exudation in the disk and in the adjoining part of the retina. No tenderness on percussion over any part of the skull.

December 1, 1883. Since entrance into the hospital, the condition of the patient has not changed materially. She had ten fully developed unilateral convulsions between time of entrance and August 21, 1883, since which time she has had no convulsion, although she has had some abortive attacks. The unilateral convulsions which she had in the hospital have all commenced in the left foot and gradually extend up over the whole left side of the body, the right never being affected. The convulsive movements are clonic contractions of the muscles of left leg, left arm, left side of neck, left side of face, left side of tongue, and left eyelid and eyeball. Consciousness persists during the earlier part of the attack, but soon becomes more or less completely lost. Each attack can be promptly arrested by the inhalation of ether, and when so arrested does not return when the ether is withdrawn. After these attacks it has been noticed that the left side of the body is decidedly weaker than before and the strength returns slowly. Besides these attacks she has attacks of convulsions limited to the left leg. In addition to these convulsive attacks she has numerous attacks of a curious nature in which all mental action seems to be abolished. She will sit as if in a trance, perfectly motionless, unable to answer any question or to do anything that she is told, for a space varying from a few minutes to an hour or more, when she will suddenly come to herself and be entirely natural again. When she comes to herself she sometimes has no memory of anything that has happened, while at other times she has a pretty clear idea of all that took place in the room while she was in the fit. At other times, while in such a fit and incapable of answering questions, etc., she keeps repeating over and over the phrase "Lord, have mercy on me!" and in all her fits she never uses any other phrase than "Lord, have mercy on me!" She has had much pain at times in left side, especially in left side of skull, and has had several severe attacks of nausea and vomiting.

August 1, 1884. Has been more comfortable during the past eight months. Has not had more than half a dozen unilateral convulsions, and has had less pain in left side of head. Feels a little stronger and can walk a little better with the aid of a cane. No decided change is found on physical examination except that there is now at times decided

tenderness on percussing the skull over the upper posterior part of the right parietal bone, and that there is slight but evident left facial paresis which is especially well marked after a convulsive attack. The remedies which seem to benefit her the most are small doses of bromide of potassium or of chloral.

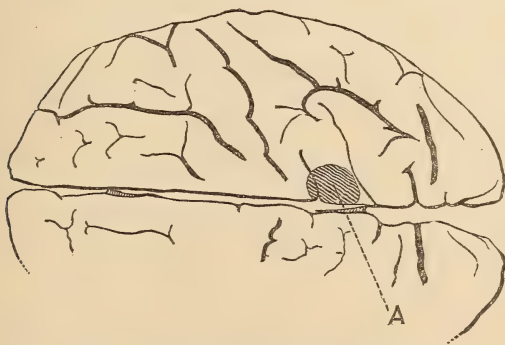
October 30. Slowly failing during past few days. To-day lies in a semi-comatose state, with the head, but not the eyes, turned toward the right. She answers questions in monosyllables. Tongue protruded fairly straight. She cannot move either left arm or leg, which are flexed and moderately rigid.

November 1. This evening the pupil of the right eye was contracted and did not respond to light, while the pupil of the left eye was dilated and did respond to light. Temperature $106\frac{1}{2}^{\circ}$ F. All these symptoms disappeared in a few hours and did not recur.

3d. Entirely comatose. Left side of body completely relaxed. Some resistance offered to passive motion on right side. Eyes examined by Dr. Merrill, with the following results: Outlines of nerves are indistinct, arteries small; both arteries and veins are very tortuous. Retinæ in the neighborhood of the nerves and extending well out toward the periphery are cedematous, and present an unusually opaque appearance. The appearance of both eyes is much alike, except that in the left eye the arteries and veins are much smaller and more tortuous.

4th. Patient died to-day. *Autopsy* held five hours after death. Skull cap unusually dense and not symmetrical, being unusually hollowed out at a point near the right parietal eminence. Dura mater not so adherent to skull cap as usual; inner surface of dura mater normal. Pia mater normal except for much congestion of both the larger and smaller veins. Base of brain normal. Cerebral convolutions are generally flattened. Lying close against the superior longitudinal sinus and just posterior to the upper extremity of the posterior central convolution on the right side is a hard ovoid tumor, measuring one and one-half inches in its longer, and one and one-quarter inches in its shorter

FIG. 4.



Superior surface of right hemisphere, after Ecker.
A, depression caused by tumor.

diameter. The tumor pressed on the cerebral substance, causing a rather deep concavity in the most anterior part of the right superior parietal

lobule on the very edge of the superior longitudinal fissure. The tumor is firmly adherent to the dura mater and around its periphery the dura mater, the pia mater, and the cerebral cortex are all firmly adherent to the tumor and to each other. Just beneath the tumor the cerebral substance is slightly softened. The left lateral ventricle is dilated in all its parts, while the right lateral ventricle is rather smaller than normal, and its posterior horn is almost completely obliterated. Sections through the brain and spinal cord show no other lesions.

On microscopical examination the tumor was found to be an endothelioma. It presented a well-marked alveolar structure, and the cells were flat and had a concentric arrangement. No descending degeneration could be found either in the spinal cord or in the pyramidal tract at the base of the brain.

In the first three cases the lesion was a cerebral atrophy which simply put certain portions of the brain out of action. In Case IV., however, the lesion is a tumor which, in its growth, pressed upon and irritated the cerebral cortex and the cerebral meninges, and consequently in this case we get for the first time symptoms of cerebral irritation—*i. e.*, nausea and vomiting, and pain and convulsions limited to the opposite side of the body. In this case the tumor never actually destroyed the cerebral cortex, and, therefore, the symptoms of irritation were never completely replaced by those of paralysis, although toward the end of the patient's life the convulsions became rarer and the hemiparesis became more decided.

The principal symptoms in the case were the pain, the convulsive attacks, and the attacks in which the patient was unable to answer questions or to perform any other voluntary action. It has long been known that the nearer a tumor is to the surface of the cerebral hemispheres the greater is the pain that it causes, and this tumor growing in the meninges caused paroxysmal attacks of intense pain throughout the left side of the body, and was especially constant and severe over the whole left side of the head. The distribution of the pain is difficult of explanation. The most reasonable supposition is that it was due to irritation of the cortical termination of the sensory nerves of the left side of the body, especially of the fifth nerve; and yet, according to our present views of cerebral localization, the fibres from the fifth nerve terminate in the lower rather than in the upper part of the central convolutions. It was only toward the end of life that there were pain and tenderness over the seat of the tumor.

Unilateral convulsions have been very frequently noticed in cases of tumors and other irritative lesions of the cerebral cortex. Such convulsions are sometimes called cortical epilepsy or Jacksonian epilepsy, after J. Hughlings Jackson, who has long given them especial attention and study, and who insists on the importance of the temporary paresis following the convulsion and limited to the muscles taking part in the

convulsion, which temporary paresis was well marked in Case IV. It is customary in these cases for the convulsion to commence in that part of the body which is connected with that portion of the cortex in which the lesion is situated, and, accordingly, in this case the convulsive movements always began in the left foot; the tumor lying in the cortical centre for the left leg. In many cases the convulsion, although commencing on one side, soon becomes general and is associated with loss of consciousness, thus closely simulating epilepsy. It is such cases which have given much support to the theory of the cortical origin of epilepsy, which has now replaced the vasomotor theory of epilepsy; although true epilepsy is entirely distinct from such epileptiform convulsions dependent on gross disease of the brain. In Case IV. the convulsions were never general, and the loss of consciousness was often incomplete.

Besides the unilateral convulsions, the patient had another form of attack which is very interesting, and which has never to my knowledge been noticed in cases of cerebral tumor. In the attacks of this kind consciousness, although obscured, was rarely or never completely lost. The patient was in a kind of trance; she knew what was going on about her and tried to answer questions and to do what she was told, but there seemed to be an inhibition put upon all action. The most she could do in the milder attacks was to say "Lord, have mercy on me." These attacks in many respects resembled the attacks of petit mal of epileptics. We know that from the motor area of the cortex two kinds of impulses originate and pass down along the pyramidal tract to the sub-cortical centres. One kind of these impulses sets the sub-cortical centres in activity and causes movements; the other kind stops the activity of the sub-cortical centres and inhibits movement. Destructive lesions, either of the motor area in the cortex or of the pyramidal tract, destroy voluntary movements, and, at the same time, by destroying inhibition, increase reflex movements. In Case IV. it seems that the irritation of the tumor caused at one time a discharge of motor impulses which set the sub-cortical centres into activity and produced the convulsive movements, and at another time caused a discharge of inhibitory impulses which repressed all activity of the sub-cortical centres and prevented movement. It seems then as though the two contradictory forms of activity which this portion of the cortex manifests in health, and which cause respectively movement and inhibition, were both reproduced in an abnormal discharging manner by the irritation of the growing tumor.

Besides these symptoms, there was in this case a left hemiparesis which was always more decided immediately after a convulsion, and which was due in part, perhaps, to the left-sided convulsions, but certainly in greater part to the direct pressure of the tumor upon the cortex. Although the action of the tumor was confined to the cortical centre for the leg, yet the paresis was not confined to the leg, but affected

also the arm and face to a less degree. This would indicate that in each cortical motor centre the face, arm, and leg are all represented to a varying degree, and that there is no sharp line to be drawn between the centres. This and many other cases can be better explained in this way than by the supposition of transmitted pressure. Certainly it is very rare to find a cortical lesion so small that it causes disturbance in only one member.

In all the cases so far reported in this article the lesion has been confined to the cortex of the posterior part of the brain and has in no instance extended in front of the fissure of Rolando. I have not had any case in which the cortex of the frontal lobe was involved, but I will report briefly three cases in which the lesion involved the white matter of the frontal lobe.

CASE V. *No symptoms, coma; tumor of frontal lobe.*—W. Mc. P., male, æt. forty-four, widower. Always healthy. Infected with syphilis eight years ago. During the past year and a half he has been troubled by a varicose vein in his leg which has ruptured four times, causing a great loss of blood each time. Otherwise he has felt well except that he has felt weak of late, on which account he entered the hospital. On entrance he exhibited anæmia and general weakness, which were attributed to the excessive loss of blood. No paralysis of motion or sensation and no aphasia could be discovered. Eyes were not examined. Four days later he became comatose and the next day he died. At the autopsy a tumor as large as a small hen's egg was found in the lower part of the right frontal lobe near its middle, surrounded by a narrow zone of yellow softening. Tumor was dense, mahogany-colored on section, subdivided by indistinct septa and contained several distinct hemorrhages.

CASE VI. *Convulsions, aphasia, somnolence, coma, death; abscess just anterior to left corpus striatum.*—H. T., male, æt. forty-three, married. Enjoyed good health until one day when, without any warning, he had a severe convulsion followed by unconsciousness for about an hour, when he had a second convulsion which was also followed by unconsciousness for an hour, after which he recognized persons about him and appeared well. During the next fortnight he went out, but seemed averse to bodily or mental exertion. He grew more and more listless and dispirited. He complained of paroxysmal pain in his left eye and darting through his temples. There was no paralysis of any sort, but there was a slight degree of aphasia. His pulse did not vary much from 80. He steadily grew more and more drowsy, became comatose, and died just one month after his first convulsion. At the autopsy two encapsulated abscesses, each the size of a small hen's egg, and communicating with each other, were found a little in front of the left corpus striatum; the top of the upper abscess being on a level with the floor of the lateral ventricle. The cerebral substance in the immediate neighborhood of the abscess was the seat of a softening which involved the anterior part of the corpus striatum and the convolutions of the island of Reil.

CASE VII. *Convulsions, aphasia, paralysis of leg, somnolence, death; tumor involving the whole of the medullary substance of the left frontal*

lobe.—M. D., female, æt. thirty-nine, married, always enjoyed good health till one day when, without known cause, she was seized with three epileptoid convulsions in succession, after which she remained comatose for a few hours, and then seemed to be perfectly well again. These attacks occurred on the same day that her menstrual discharge ceased. One month later, on the last day of her menstruation, she had another set of altogether similar convulsions, and still again, one month later, the attacks recurred. Just before the termination of the next menstruation twenty leeches were applied to the inside of the thighs, and a brisk cathartic was administered with the result that the convulsions did not appear till two weeks later. After this they continued to appear at irregular intervals which were seldom less than four weeks. Except for the convulsions she continued in fair health for five months, when she began to complain of paroxysmal pain in both temples, especially in the left one, and became listless and dispirited, and had also severe attacks of vomiting. Three months later the right leg became so weak that she could not walk, and her eyesight began to fail. Eyes were not examined ophthalmoscopically. She became more and more listless and developed well-marked aphasia. Ten months after her first convulsion she had a severe convulsion, after which she remained unconscious, and vomited constantly. The right side remained nearly motionless, while the left arm and leg were in continual motion. On the morning of the next day she died. At the autopsy a gelatinous tumor was found occupying the place of the whole of the medullary substance of the left anterior lobe. The tumor cut tough and gave the sensation as though the scalpel was drawn over wool. It reached to within half an inch of the surface of the hemisphere. The cerebral substance around it was softened; the corpus striatum being involved in the softening.

Case V. shows that a large tumor may exist in the frontal lobe without giving rise to any symptom until it causes coma and death. Numerous cases are on record which prove the same thing, and it is now generally accepted that lesions of the frontal lobe may cause no characteristic symptoms (except perhaps an ill-defined change in the character and disposition of the patient) unless they are so far back that they involve the motor centres, or unless they involve the posterior part of the left inferior frontal convolution, in which case they produce aphasia. It is well known that in the left inferior frontal convolution take place those cellular actions which are essential to the production of the innervation feelings necessary for speech, and lesions of this convolution produce motor aphasia—*i. e.*, the more or less complete inability to speak, just as lesions of the left superior temporal convolution causes sensory aphasia—*i. e.*, the inability to understand spoken words, and hence irrelevant speech. In Case VI. the softening about the abscess involved either the left inferior frontal convolution or the fibres coming from it, and produced a slight degree of aphasia; while the extensive lesion in Case VII. involved not only the fibres from the inferior frontal convolution but also some of those from the central convolutions, and produced not only well-marked aphasia but also paralysis of the right leg.

Cases VI. and VII. are good examples of general convulsions depend-

ing on tumors of the anterior lobes, just as Case IV. was a good example of localized convulsions dependent on a tumor located in the motor region of the cortex. The fact that the cessation of menstruation acted as an exciting cause for the convulsion in Case VII. and that a free bleeding at that time delayed the appearance of the convulsion is very interesting.

From this study of cerebral localization, the following conclusions may be drawn :

1st. The greater part of the cerebral cortex can be divided into small areas, each of which is functionally associated with a definite mode of mental action, and is consequently called the cortical centre for that action.

2d. The cortical centres connected with the sensory nerves are situated in the posterior half of the cerebral cortex including the temporal lobe ; and the cortical centres connected with the motor nerves are situated in the middle portion of the cerebral cortex and in the posterior part of the cortex of the anterior lobe.

3d. Each sensory cortical centre probably consists of two parts ; a smaller one in which the peripheral nerve has its final termination and in which take place those molecular changes which correspond to simple sensation ; and a larger one in which take place those molecular changes which correspond to the mental processes of memory, judgment, and comparison which together constitute complete perception and recognition.

4th. Each motor cortical centre probably consists of two parts : a smaller one in which the peripheral motor nerve has its origin, and in which take place those molecular changes which correspond to the action of the will in originating voluntary movements ; and a larger part in which take place those molecular changes which correspond to the memories of coördinated muscular innervation which are factors in the production of voluntary movements.

5th. The optic fibres from the right upper quadrant of each retina terminate in the lower half of the right cuneus. (See Case I.)

6th. The optic fibres from the right lower quadrant of each retina terminate in the adjacent part of the right median occipito-temporal convolution. (See remarks on Case I.)

7th. The lower half of the cuneus and the adjacent part of the median occipito-temporal convolution is the point of termination of the optic fibres from homonymous halves of the retinae : the right half of each retina being represented in the right occipital lobe and the left half in the left lobe. (See remarks on Case I.)

8th. Functional activity of the cortex of the median surface of the occipital lobe is necessary for simple visual sensation. (See remarks on Case II.)

9th. Functional activity of the cortex of the convex surface of the left

occipital lobe is necessary for full visual perception and recognition and for the production of visual memories. (See remarks on Case II.)

10th. The temporal lobe is the cortical centre for hearing and complete destruction of a temporal lobe or of the auditory fibres running to it causes complete deafness of the opposite ear. (See remarks on Case II.)

11th. Functional activity of the cortex of the left superior temporal convolution is necessary for the perception and recognition of spoken words and for the production of the memory of these words; lesions of this part causing inability to understand spoken words and sensory aphasia. (See remarks on Case II.)

12th. Functional activity of the cortex of the left angular convolution is necessary for the production of memories of the appearance of written or printed words; lesions of it causing alexia and agraphia. (See Case III.)

13th. Only in virtue of the fact that on its functional activity depends the production of the memories of the appearance of written or printed words can the angular convolution be considered as forming part of the visual centre. It does not constitute the visual centre, as Ferrier claims. (See remarks on Case III.)

14th. The cortical centre for the leg includes the paracentral lobule, the upper third of the two central convolutions, and the greater part of the superior parietal lobule. (See Case IV. and remarks on Case III.)

15th. The cortical centre for the arm includes the posterior part of the superior frontal convolution, the middle third of the two central convolutions, and the anterior part of the inferior parietal lobule. (See Case III. and the remarks on it.)

16th. The cortical centre for the face includes the lower third of the two central convolutions, especially the anterior one. (See remarks on Case III.)

17th. In the anterior part of the cortical centre for the arm originate the nerve fibres for the arm, and lesions of this part cause absolute paralysis of the arm. The same thing is probably true in the case of the cortical centres for the leg and face. (See remarks on Case III.)

18th. In the posterior part of the cortical centre for the arm take place those molecular changes which are necessary for the production of memories of coördinated muscular innervation. The same thing is probably true in the case of the cortical centres for the leg and face. (See Case III. and the remarks on it.)

19th. No sharp line can be drawn between the motor centres of the leg, arm, and face of the same side, and it is very possible that in each centre all three parts may be more or less completely represented. (See remarks on Case IV.)

20th. The cortical centres for muscular and cutaneous sensibility are

the same as those for motility, and probably extend backward beyond the latter over the parietal lobe also. (See remarks on Case III.)

21st. The faculty of speech cannot be located in any one portion of the cortex, and aphasia can be produced by a lesion situated in various parts of the left cerebral hemisphere; the right hemisphere apparently not being concerned in the production of speech except in the case of left-handed persons. The memories of the muscular innervation feelings necessary to produce spoken words depend on the functional activity of the cortex of the left inferior frontal convolution. The memories of the sound of spoken words depend on the functional activity of the cortex of the left superior temporal convolution. The memories of the appearance of written or printed words depend on the functional activity of the left angular convolution. These centres are all connected together by means of association fibres. The faculty of speech in its completeness depends on the integrity of all these parts, except, perhaps, that of the angular convolution. According as one or the other of these parts is affected, the symptoms of one or the other of the principal varieties of aphasia are produced. Motor aphasia is due to a lesion of the left inferior frontal convolution or of the white matter immediately beneath it. (See Cases VI. and VII.) Sensory aphasia is due to a lesion of the left superior temporal convolution (see Case II.), perhaps also to a lesion of the left angular convolution (see Case III.). Conduction aphasia is due to a lesion of the association fibres mentioned above. (See remarks on Case III.)

22d. Tumors or other irritative lesions situated in the non-motor region of the cerebral hemispheres can cause general convulsions associated with loss of consciousness. (See Cases VI. and VII.)

23d. Tumors or other irritative lesions situated in the cortical centres for the leg, arm, or face, may cause convulsions commencing in the leg, arm, or face, respectively, and which may become general, though they more frequently remain unilateral, and which are sometimes associated with loss of consciousness and sometimes not. (See Case IV.)

24th. Tumors situated in the cortical centre for the leg may produce a trance-like condition, or conditions resembling the attacks of petit mal of epileptics. (See Case IV.)

REVIEWS.

SURGICAL DISEASES OF THE KIDNEY. By HENRY MORRIS, M.A., M.B., F.R.C.S., Surgeon to and Lecturer on Surgery at the Middlesex Hospital, London. 12mo. 555 pages, with 6 chromo-lithographic plates and 40 engravings. London: Cassell & Co. Philadelphia: Lea Brothers & Co., 1886.

THIS work is one of the excellent "Manuals" which have been published during the past year or so, and is designed to furnish a comprehensive treatise upon the surgical diseases of the kidney, at a reasonable price. We especially commend the publishers for their praiseworthy effort to furnish standard medical literature at such rates as shall be within the reach of practitioners of modest incomes; and we think the effort has succeeded, not only in regard to the character of the contents, but in the mechanical execution as well.

The present work is written by Mr. Henry Morris, a surgeon who has achieved marked distinction in renal surgery. This manual is very comprehensive. After a short description of the regional anatomy of the kidney, and of the surface-markings corresponding to it, the author devotes very interesting chapters to the misplacements and malformations of the organ, many of which conditions are admirably illustrated by cuts. A distinction is made between movable and floating kidneys, which is not usually borne in mind. "A kidney is 'movable' when, though appreciably mobile to a greater or less extent, it is situated entirely behind the peritoneum. It is 'floating' when the peritoneum so completely envelops it as to form a mesonephron." As, however, a movable kidney may enjoy as great a latitude of motion as a floating kidney, it is evident that the terms are more anatomical than clinical, but the recognition of the separate conditions is of importance when operations are contemplated upon this organ. "The usual subjective symptoms of movable kidney are pain, sense of dragging weight in the abdomen, sickness, loss of appetite and other symptoms of dyspepsia, irregularity of the bowels, and possibly, though not probably, some disturbance of the urinary organs," and when these symptoms are reinforced by the physical signs of a movable abdominal tumor, of a more or less characteristic renal contour, which can often be made to return to its normal position by pressure, the diagnosis is reasonably safe; but there are other conditions which may be mistaken for a displacement of the kidney, as tumors of the omentum, pancreas, and mesentery, distention of the gall-bladder, and ovarian cystomata with long pedicles.

Another affection for which a wandering kidney has been mistaken, seems to have been overlooked by the author, viz., carcinoma of the pylorus.

A remarkable instance in which Prof. Billroth mistook a movable kidney for a pyloric cancer, is related by himself in *Wien. med. Wochenschrift*, 1884. A woman twenty-eight years of age had had progressively increasing dyspepsia for three years, until she became emaciated and very weak, and vomited incessantly, and a tumor tender upon pressure was felt in the region of the pylorus. On August 17, 1881, the operation for removal of the pylorus was begun, but when the abdomen was opened, the digestive organs were found to be healthy, and the right kidney displaced. On the other hand, Lauenstein (*Arkiv f. klin. Chirurg.*, vol. xxviii.) performed laparotomy for the removal of a supposed wandering kidney and found he had to deal with a cicatricial contraction of the pylorus. These and other errors in diagnosis make it important to be prepared for any emergency, when operations upon the kidney are undertaken. The treatment of movable kidney is generally palliative and hygienic, but if threatening symptoms occur, nephrorrhaphy or the suturing of the organ to the abdominal wall, and nephrectomy are the alternatives. The first operation should be tried before removal of the kidney is performed.

The author calls attention to the importance of bearing in mind the fact that only one kidney may exist, as operations have been performed for the removal of this organ, and at the autopsy it was found that there had been but one kidney. Single kidneys are divided into three varieties: A. Unsymmetrical kidney—*i. e.*, entire absence of one kidney. B. Atrophy, including congenital atrophy. C. Solitary kidney—*i. e.*, fusion of the two kidneys into one mass, and including horseshoe kidney. It is hard to see any necessity for these terms, and they are confusing. It seems to us it would have been better to call the "unsymmetrical" kidney, simply "single," and the "solitary," "fused," and then the name would have more closely described the condition. Under the head of absence of both kidneys is mentioned a case reported by M. Moulon, of Trieste, in which a girl of fourteen died of gastroenteritis, and at the autopsy neither kidneys, ureters, nor bladder were found. The girl urinated from the umbilicus, and it is probable that the urinary products were excreted by the liver, and carried by the umbilical vein to the umbilicus, which was located at the mons veneris. It is difficult to believe this account, but it is related circumstantially and seems to have been carefully observed and investigated. Almost equally incredible is the case reported by Vieusseux, of Geneva, in which there was suppression of urine for seventeen months, with reëstablishment of the renal function at the end of that time.

About one hundred pages are devoted to the consideration of injuries and wounds of the kidney, and the subject is handled in a thorough manner. It is well to remember that the kidney may be contused or ruptured without external lesion, and, according to our author, subparietal rupture is by no means unfrequent as the result of falls, crushes, or direct violence. In such cases the diagnosis is frequently very difficult, as there are no constant symptoms by which the lesion may be distinguished. Hæmaturia is the most characteristic sign of ruptured kidney, but it is not pathognomonic of this injury, and there may be rupture or laceration of the kidney without any bloody urine, owing to the plugging of the ureter with a clot. Contrary to what one would expect, there may be extensive rupture of the kidney without any

extravasation of urine into the tissues, provided the pelvis and calices are not torn; when this accident happens, urine will escape.

Mr. Morris, after laying down a rational mode of treatment of ruptured kidney—rest, the use of astringents to control bleeding, ice, and the cold coil—makes a suggestion to perform lumbar nephrectomy when there is “profuse and continuous hæmaturia, especially if the bleeding is rapid and arterial.” The subjects of perinephritis, hydro- and pyonephrosis are treated of at length. Especial attention is called to the attitude assumed by patients suffering from perinephritis, the thigh of the affected side being somewhat flexed, and the body bent forward and inclined toward the same side, simulating quite closely hip disease in its earliest stages. It is to be distinguished from coxalgia by the unrestricted mobility of the hip, as well as by the presence of the signs characteristic of perinephritis. Such a case came under our notice recently, where, from a slight injury to the lumbar region, the patient experienced pain above the iliac crest, and for a long time walked in the above mentioned manner. There was, however, normal mobility of the hip-joint, and an entire absence of pain, tenderness, or swelling in the gluteal region. “Hydronephrosis is the term applied to overdilatation of the kidney with urine. It is a mechanical result of obstruction to the outflow of urine from the kidney, no matter whether the cause be situated in the urethra, bladder, or ureter.” The treatment is purely surgical. Aspiration or tapping may be first tried, and, if unsuccessful, nephrotomy and drainage. Nephrectomy can only be thought of as a last resort, when the patient’s life is endangered by a continuance of the affection. Pyonephrosis is stated to be mechanical obstruction, plus pyelitis, and is frequently due to blocking of the renal pelvis with a calculus.

The author condemns the term “surgical kidney” as being unscientific and misleading, whilst suppurative pyelonephritis accurately describes the pathological lesions found in such cases. It is impossible to do more than notice a few of the good features of this work, and we have not discovered any that are bad. In regard to the prevention of “urinary fever,” the caution is given, never to explore the bladder for the first time without some previous preparation of the patient, such as several days’ rest in bed, regulation of the bowels and diet, and, if any malarial poisoning is probable, the use of quinine. Just previous to the introduction of an instrument, a subcutaneous injection of morphine, or five to twenty grains of quinia should be given, and in highly nervous persons the examination should be conducted during anæsthesia. These facts are well known to surgeons, but bear repeating.

Chapter XXIX. is devoted to renal calculus, a subject with which Mr. Morris’s name is closely associated. Whilst stone in the kidney of sufficient size to produce serious symptoms is rare, physicians should be on the alert to detect such concretions before the organ has become disintegrated, since such conditions are now accessible to operative procedures. The most frequent signs of renal calculus are, pain in the back, usually aggravated by motion or sudden shocks; often severe colicky pains; and sometimes vomiting. The urine, also, usually at some period contains blood, pus, or albumen; pain reflected along the groin and into the testicle may also be felt; and the calls to empty the bladder are more numerous than normal. The surgical treatment of this condition is thus tersely summed up by the author:

"Nephrolithotomy, therefore, is the operation for stone in the kidney. Nephrotomy is the operation for calculous pyelitis, or calculous hydro-nephrosis or pyonephrosis." Nephrectomy "should never be undertaken until after the kidney has been thoroughly explored, not only with the finger and exploring needle, but also by incision of the calices of the kidney and a digital examination of the interior of the renal cavity. But if a stone cannot be detected by these means, and yet symptoms point definitely to the presence of one, and the patient's life is useless or insufferable from the pain or hemorrhage, it would be right and wise to perform nephrectomy."

These statements have almost the force of aphorisms, and can scarcely be improved upon by more wordy directions.

Tumors of the kidney are sufficiently but not exhaustively dealt with, and valuable remarks are made in regard to their diagnosis from other abdominal growths. We have no desire to be captious in regard to any slight defect in such a valuable work, but we think that a few more details in regard to the indications for treatment of renal tumors might have added to the completeness of this section. Any one who seeks information upon the subject of this treatment of solid renal tumors must satisfy himself with the following dictum: The treatment "can only be palliative in the middle and later periods of the disease. In the very early stages, could the growth be recognized, then nephrectomy would seem to offer a prospect of postponing the fatal result, perhaps even of considerably prolonging life, and in exceptional cases of securing permanent immunity." This refers only to malignant tumors, and the treatment of benign tumors is entirely omitted.

In a valuable article published in this journal in July, 1885, S. W. Gross formulates the following propositions: "That primary extirpation of the kidney is indicated, first in sarcoma of adult subjects; secondly, in benign neoplasms at any age;" and "that nephrectomy is absolutely contraindicated, first in sarcoma of children, secondly in carcinoma at any age, unless, perhaps, the disease can be diagnosticated and removed at an early stage." The last chapter is devoted to operations on the kidney, which, exclusive of aspiration and tapping with a trocar, are at present only four in number; nephrotomy or the incision into the kidney; nephrorrhaphy, or the suturing of the kidney to the abdominal parietes; nephrolithotomy, or the removal of a calculus from the kidney; and nephrectomy, or total extirpation of the organ.

These operations have all been performed sufficiently often to give them the position of recognized surgical procedures. Simple nephrotomy is the operation for relief of cystic conditions of the kidney, such as hydronephrosis, pyonephrosis, hydatid cysts, abscess, and pyelitis. In such conditions incision of the kidney should always precede extirpation, since the mortality of nephrotomy, in suppuration of the kidney, according to Gross, is but 23.65 per cent., whilst that of nephrectomy in the same affection is 43.97 per cent. Nephrorrhaphy is an operation designed to attach a movable kidney to the posterior abdominal wall. It was originated by Hahn, of Berlin, and has been performed a number of times with fair success. Morris says it has been done but eight or nine times, but with almost universally good results. Gross says it has been practised eighteen times, with one death, and that it fails to retain the organ in its position in nearly one-half of all the cases operated on. Billroth also speaks discouragingly of the operation, and says: "Unfortunately, the efforts of Hahn, of Berlin, at fixation, have had no lasting

good results." This operation should always be performed for painful floating kidney before the more serious method of nephrectomy is undertaken.

Nephrolithotomy, or the removal of a calculus from the kidney, was performed for the first time by the author in 1880, and has since been done twenty-one times, according to Gross, with two deaths, or 9.52 per cent. Twenty-four exploratory operations have also been performed where no stone was found, and the patients all recovered; hence, when symptoms of calculus are present, and the life of the patient is rendered miserable, an operation should be undertaken for the removal of the concretion, and the organ should only be removed when it is entirely disorganized, or when the stone cannot be detected, and the patient's life is endangered. The kidney was first removed by Dr. E. B. Walcott, of Milwaukee, through a mistaken diagnosis; but to Simon, of Heidelberg, is the credit due of first intentionally extirpating the kidney, and, as stated by Professor Billroth, "it must always be considered a fortunate circumstance that the first extirpation of the human kidney succeeded." He evidently did not know that the viscus had been thrice removed previously, with fatal results, as is shown by Dr. R. P. Harris's statistics in this journal in July, 1882. It is, however, fortunate that the first planned nephrectomy terminated favorably, as the justifiability of the operation was at once established.

The mortality of nephrectomy varies with the affection for which it is performed, but the combined mortality, as is shown by the statistics of several authors, does not vary much. Thus Harris, in 1882, gives the mortality at 45 per cent.; Billroth, in 1884, from larger statistics, makes the death-rate 47 per cent.; and Gross, in 1885, having collected 233 nephrectomies, finds the mortality to be 44.63 per cent. Of the two methods of performing nephrectomy, the lumbar and the abdominal, the former should always be performed when possible, as the mortality is very much less. Mr. Morris says: "Though in some cases from the size of the tumor the abdominal operation is easier, and therefore safer, the lumbar method is, as a rule, much safer, and to be preferred in all cases where the kidney is not greatly enlarged, where the tumor can be reduced by puncture, and when the loin space is not too much contracted."

For the benefit of any one who may be ambitious to extirpate a kidney, we append a few additional remarks of the author. He says:

"But here I would emphatically endorse the teaching of Simon, who laid it down as a cardinal principle that extirpation of a kidney is only permissible when a patient's life is seriously threatened by disease, and all other remedies have failed, because renal disease is more dangerous in persons with only one kidney. The suffering caused by a floating kidney ought therefore to be quite unrelievable by other means before the patient is exposed to the great risks, operative and prospective, of nephrectomy; and in renal calculus no pains should be spared to procure relief by nephrolithotomy before proceeding to the much graver operation of excision."

It must also be remembered that every effort must be made to determine the condition of the opposite kidney, and, in fact, to ascertain its presence before extirpation is performed. The case of Dr. Polk, of New York, where, after removal of a floating kidney, the patient succumbed, and the autopsy revealed the fact that she had had a solitary kidney, is an illustration of this point.

We are admonished, however, that we are not writing an essay upon renal surgery, but are reviewing a most interesting and instructive work upon this subject. We are sure that no words of ours can commend the book more than the summary of its contents and the extracts from its pages which have been made. Besides the pleasure we have had in reviewing an excellent work upon a most important subject, we have had an additional gratification in noting the many references to the work of American surgeons. The article upon renal operations may be read advantageously in connection with Dr. Harris's "Analytical Examination of One Hundred Cases of Extirpation of the Kidney," published in this journal in July, 1882; with Professor Billroth's lecture on "Extirpation of the Kidneys," in the *Wiener medicinische Wochenschrift*, Nos. 23, 24, and 25, 1884; and with Prof. S. W. Gross's valuable article in this journal of July, 1885, entitled, "Nephrectomy: Its Indications and Contraindications."

R. W.

A SYSTEM OF PRACTICAL MEDICINE BY AMERICAN AUTHORS. Edited by WILLIAM PEPPER, M.D., LL.D., Provost and Professor of Medicine in the University of Pennsylvania. Volume IV. DISEASES OF THE GENITO-URINARY AND CUTANEOUS SYSTEMS, MEDICAL OPHTHALMOLOGY, AND OTOTOLOGY. Pp. 877. Volume V. DISEASES OF THE NERVOUS SYSTEM. Pp. 1326. Philadelphia: Lea Brothers & Co. London: Cassell & Co., 1886.

VOLUME IV. is largely devoted to special subjects, and the contributors to it rank among the best known American specialists. In the section on "Diseases of the Kidneys," with which the volume opens, Dr. Edes, of Boston (now of Washington), contributes an important group of articles on "Floating Kidney," "Polyuria," "Albuminuria," and "Affections of the Pelvis. On the question of a "physiological albuminuria," about which we have heard so much of late years, Dr. Edes gives a very guarded opinion. We should have preferred a fuller discussion of this most important point, which is of such practical interest to physicians in life insurance work. Perhaps it is safer to say, in our present knowledge, "that the presence of albumen in the urine in sufficient quantity to be detected by the use of the ordinary tests is a decidedly serious symptom," though Leube, Fürbringer, Moxon, and others have maintained that the occasional occurrence may not be of much moment. In the consideration of the affections of the pelvis of the kidney, the indications for surgical interference are very carefully discussed from a medical point of view. Surgeons will find in these sections much of interest and value on the subject of diagnosis.

In a short and concise article, Dr. Delafield considers the important subject of Bright's disease, which he classifies into *acute and chronic parenchymatous nephritis*, and *acute and chronic diffuse nephritis*, admitting, however, that from a clinical standpoint nearly all the cases may be arranged into the two classes of *acute and chronic*. In the acute and chronic parenchymatous nephritis the tubules only are involved, while in the diffuse form the stroma and bloodvessels are also affected. Very few writers now recognize a pure chronic parenchymatous nephritis.

without changes in the connective tissue or vessels. It is not common, and anatomically is a form of the large white kidney. Histological examination alone could distinguish it from instances of the chronic diffuse inflammation. Under chronic diffuse nephritis, Dr. Delafield describes the atrophied or cirrhotic and the so-called large white kidney, of which he recognizes three varieties: the simple large white, the waxy large white, and the large white of cardiac disease. With marked differences in the gross appearances, the minute lesions are essentially the same. We know of no author so positive as to the essential unity of the forms of chronic diffuse nephritis. He says: "After separating the true cases of chronic parenchymatous nephritis—cases in which only the epithelium of the tubes and of the Malpighian capsules is changed—all other kidneys of chronic Bright's disease present essentially the same lesions, and give rise to the same symptoms. We can often tell, during the life of the patient, whether he has large white, or atrophied, or waxy kidneys; but in many cases such a diagnosis is impossible." Dr. Delafield has been a most painstaking student of the morbid anatomy of Bright's disease, and his views on this matter are entitled to a very careful consideration. The clinical picture which he gives of the various forms of chronic diffuse nephritis is clear and truthful.

The subjects of "Hæmaturia, or Hæmoglobinuria and Chyluria," are considered by Dr. Tyson. Both are rare conditions in the Northern States, but common enough in the South. There is an accurate description of the various forms of malarial hæmaturia. In the doubtful cases of this nature which occur in the Northern latitudes the presence or absence in the blood of the bodies described by Laveran as characteristic of malaria will be useful in determining the diagnosis. Possibly also certain of the cases may be due to the *Filaria sanguinis*. In connection with that most obscure disease, chyluria, so many cases of which in tropical countries are parasitic, the discovery of the filaria in the blood in this country by Dr. Guitèras, of Charleston, lends additional interest. Dr. Guitèras's observations have been published since this volume was issued and they should stimulate physicians to make a most careful examination of the blood in all such cases. Dr. Tyson very rightly holds that there is also a non-parasitic form of the disease.

Articles on "Diseases of the Bladder," by Dr. E. L. Keyes, of New York, and on "Seminal Incontinence," by Dr. S. W. Gross, of Philadelphia, will afford the busy practitioner much practical information in a concise form.

Almost one-half of this volume is devoted to chapters on the "Diseases of Women," fourteen in all, which together form an admirable manual of gynecology. The "Displacements of the Uterus" are discussed in a well illustrated article by Dr. E. C. Dudley, of Chicago; "Disorders of the Uterine Functions," by Dr. J. C. Reeve, of Dayton, Ohio; "Inflammation of the Pelvic Cellular Tissue," and "Pelvic Peritoneum," by Dr. B. F. Baer, of Philadelphia; "Pelvic Hæmatocele," by Dr. T. Gaillard Thomas, of New York; "Fibrous Tumors of the Uterus," "Sarcoma of the Uterus," and "Cancer of the Uterus," by Dr. William H. Byford, of Chicago; "Diseases of the Ovaries and Oviducts," by Dr. William Goodell, of Philadelphia. In the last named article we naturally turn to see what this well-known conservative surgeon says upon the subject of Battey's operation. While admitting that it has been greatly abused, he advocates it warmly in suitable cases

and has evidently obtained very striking results in truly desperate cases, as, for example, in curing by this procedure four of five cases of ovarian insanity. "Diseases of the Urinary Organs in Women" are considered by Dr. J. C. Skene, of Brooklyn; "Diseases of the Vagina and Vulva," by Dr. Edward W. Jenks, of Chicago; "Disorders of Pregnancy and Diseases of the Parenchyma of the Uterus," by W. W. Jaggard, of Chicago; and "Abortion," by Dr. George J. Engelmann, of St. Louis. In most instances the names of the authors of these articles are so thoroughly identified with the subjects of which they treat that their fitness will be generally recognized, and the Editor may be considered fortunate in having secured such an able staff of collaborators in this department. The article on "Abortion," by Dr. Engelmann cannot be passed without a reference, as it is one of the most exhaustive in the language. The historical and ethical aspects of the question are fully discussed with the writer's well-known ability.

The "Diseases of the Muscular System" form a small but interesting section. Dr. J. C. Wilson, of Philadelphia, in the paper upon "Myalgia," has made a valuable contribution to the literature of a common affection not always accurately described in the text-books. The statement which he presents of the disease as a sub-inflammatory muscular condition, neither rheumatic nor neuralgic, is particularly clear and convincing. In the section on treatment, scarcely sufficient stress is laid on the great value of acupuncture in acute lumbago.

The allotment by the Editor of "Progressive Muscular Atrophy" to a place in the section of diseases of the muscular system, illustrates the doubt which existed as to the true nature of this disease—whether spinal or myopathic. Now it is very generally acknowledged to have a central origin, and this view is adopted by Dr. Tyson, of Philadelphia, the writer of the article. With "Pseudo-muscular Atrophy" the case is different; the evidence points strongly to a primary myopathy. Dr. Mary Putnam Jacobi, of New York, has prepared an elaborate memoir on the disease, complete in detail, and will prove invaluable as a reference to subsequent writers in this field.

An extensive section on "Diseases of the Skin," by Dr. Louis A. Duhring and Dr. Henry W. Stelwagon, of Philadelphia, will enhance the value of the work to the general practitioner, who seeks a convenient guide in the diagnosis and treatment of these affections. It really forms a condensed text-book and we only regret that the scope of the work did not permit of the insertion of illustrations.

Dr. W. F. Norris has contributed the article on "Medical Ophthalmology," which extends over fifty pages, and deals systematically with those affections of the eye most likely to occur in strictly medical practice. As an adjunct to diagnosis, the ophthalmoscope is not employed with the frequency which its importance demands, and we hope that this suggestive paper by Dr. Norris may stimulate many to take up a study which is essential in the practice of certain departments of medicine.

A well-prepared section on "Medical Otology," by Dr. George Strawbridge, of Philadelphia, concludes the volume.

The fifth and concluding volume is devoted exclusively to the diseases of the nervous system. The study of neurology has made rapid strides in this country within the last twenty years, and the number of men

who devote themselves to this interesting but difficult specialty is yearly increasing. Here, again, the Editor has been fortunate enough to secure the coöperation of well-known writers, and the volume, as it stands, forms the most exhaustive text-book on diseases of the nervous system which has been issued from the press of this country.

Dr. E. C. Seguin, whose name is so closely associated with the promotion of the study of neurology in New York, contributes the introductory article on "General Semeiology of Diseases of the Nervous System," and on the "Localization of Lesions in the Nervous System." In the former the general symptomatology is considered, and the various data analyzed under psychic, motor, sensory and trophic symptoms. The diagnosis of localization of lesions now plays such an important part that we could have wished a more extended account under this head, particularly of affections of the motor zone. The recent brilliant results of Horsely illustrate the practical outcome of many years of laborious study and experimentation, and will give a great stimulus to cerebral surgery. The admirable diagrams in this section will materially assist in the accurate definition of suspected lesions.

The section on mental diseases, prepared by Dr. Charles F. Folsom, of Boston, forms perhaps the clearest and most practical account of the various forms of insanity which has appeared in America. A little amplified, and it would be a model text-book; but as it stands the practitioner will find in it a trustworthy guide, and the student of psychology a careful presentation of the subject.

Dr. Charles K. Mills, of Philadelphia, is the most extensive contributor to this volume, and has written articles on "Hysteria," and its allied affections, "Hystero-epilepsy," "Catalepsy," and "Ecstasy;" and, with Dr. Lloyd, the papers on "Tumors of the Brain and its Envelopes," and "Tumors of the Spinal Cord." The first named articles are of unusual merit, and will take a prominent place in the literature of these subjects, as there is nothing in English so full in detail and which gives so clear a picture of the manifold variations of hysteria. In many respects this work of Dr. Mills forms the most interesting part of the volume, and we welcome it the more heartily as representing for the first time, in a systematic manner and with the necessary fulness, the features of these affections as seen in America.

The question of the localization of cerebral tumors is one of special importance, and is ably discussed by the authors, who have analyzed 100 cases, selected on account, first, of the carefulness with which they have been reported, and, second, with a view of determining by clinico-pathological data the possibility of diagnosing the locality affected. The series of cases is appended and will be of value for reference. The subject of tumors of the cord and its membranes is considered in the same careful manner, upon the basis of 50 cases selected from the literature.

Dr. Mills also contributes a short article on "Progressive Unilateral Facial Atrophy."

Dr. H. C. Wood, of Philadelphia, writes the articles on "Neurasthenia," "Acute Affections produced by Exposure to Heat," and on the "Syphilitic Affections of the Nerve-centres." The subject of neurasthenia is considered in a brief, though practical manner, and is very suggestive as to diagnosis and treatment. Dr. Wood need scarcely apologize for devoting an article to this subject, which is really one of great importance to the practitioner. It is true, indeed, as he says, that the term

now very often replaces that of general debility in the records of diagnosis, and in too many instances it is an indication of neurasthenia in the diagnostic powers or the zeal of the physician. Under the caption of "Acute Affections produced by Exposure to Heat," Dr. Wood considers heat exhaustion and sunstroke, which he regards as separate affections. To his labors the profession is indebted for a rational pathology of thermic fever, and for many details of treatment, and the article combines the scientific and practical in the happy style of this writer. No one in the United States has done more to advance our knowledge of cerebral syphilis than Dr. Wood, and in his article on "Syphilis of the Nerve-centres" shows, on every page, his wide experience in this department.

Dr. Wharton Sinkler, of Philadelphia, contributes an interesting set of papers on "Headache, Tremor, Paralysis Agitans, Chorea, and Athetosis." The article on "Chorea" is based on 282 cases at the Infirmary for Nervous Diseases, and presents a careful study of the clinical features of this common disease.

The article on "Vertigo," by Dr. S. Weir Mitchell, is an admirable clinical presentation of an obscure, and often obstinate affection.

Dr. Allen McLane Hamilton, of New York, considers the subject of "Local Convulsive Disorders and Epilepsy." In the latter article the practitioner will find much of interest, and the author speaks with the authority of one who has made a prolonged study of the disease.

"The Neural Disorders of Writers and Artisans" are very fully discussed by Dr. Morris J. Lewis, of Philadelphia, in a paper which must be regarded as one of the most valuable in the volume. We have but one fault to find in it, and that is in the name which he suggests, Copodyscinesia. Certainly it describes the chief characteristics of an affection with very varied symptoms, and perhaps we are unreasonable in our objection, but we have reached the period in professional life when a new name flurries; still, let us be thankful, as this is the only new one which the "System" contains.

The subject of "Tetanus" is dealt with by Dr. P. S. Connor, of Cincinnati, in a very comprehensive manner.

The article on "Disorders of Speech," by Dr. Edward P. Davis, of Chicago, is clear and concise, rather brief, perhaps, for so important a subject,

Dr. James C. Wilson, of Philadelphia, contributes an article on "Alcoholism," in which every aspect of this question is considered in detail. The arrangement which the author follows seems to us to be specially good. The tabular classification of cases of alcoholism would make a splendid campaign document for a Prohibition candidate.

The section on the "Opium Habit and Kindred Affections," by the same writer, will be found a most serviceable contribution, particularly in the question of treatment of this obstinate habit. Dr. Wilson also writes the article on "Chronic Lead Poisoning."

The various "Meningeal Affections" are ably discussed by Dr. Francis Minot, of Boston, who also writes the article on "Chronic Hydrocephalus."

Dr. John Ashhurst, Jr., contributes a short paper on "Spina Bifida."

Dr. E. C. Spitzka, of New York, contributes several very important sections. The article on "Anæmia and Hyperæmia of the Brain and Spinal Cord" is, we think, extended out of all proportion to the importance of

the subject, though the author treats of these conditions in a very pleasing and instructive manner. The papers on "Acute and Chronic Affections of the Cord" are much more satisfactory; that on "Tabes Dorsalis" is a model of careful clinical study.

In considering the question of "Concussion of the Brain and Spinal Cord," Dr. William Hunt, of Philadelphia, briefly, but clearly, states the chief features of these conditions, which are rather surgical than medical. His remarks on "railway spine" will be read with interest, as embodying the experience of a surgeon who has had, for many years, unusual facilities for studying the injuries of the back.

Dr. R. T. Edes, of Boston (now of Washington), contributes an extended article on "Intracranial Hemorrhage," which contains a very careful clinical account of the various forms of apoplexy. The question of diagnosis is very fully considered.

One of the ablest and most critical articles in the volume is that by Dr. Mary Putnam Jacobi, of New York, on "Infantile Spinal Paralysis." The practitioner will find an unusually good and complete account of the treatment of this serious affection.

Dr. Schmidt, of New Orleans, contributes three short articles on "Atrophy and Hypertrophy of the Brain," "Disease of One Lateral Half of the Spinal Cord," and on "Progressive Labio-glosso-laryngeal Paralysis."

No subject in neurology has attracted more attention of late than "Diseases of the Peripheral Nerves," which is considered by Dr. Francis T. Miles, of Baltimore. Even since the preparation of his paper there have been very important communications and it seems clear that peripheral neuritis plays a much more important part in affections of the nervous system than we had heretofore supposed.

The various forms of "Neuralgia" are discussed by Dr. James J. Putman, of Boston, in a most practical article in which the physician will frequently find many valuable suggestions for diagnosis and treatment.

The volume concludes with an admirable account of the "Vasomotor and Trophic Neuroses," by Dr. M. Allen Starr, of New York.

Altogether, Volume V. not only maintains the high standard of the previous volumes, but we should be inclined to say that it represents the best work of the entire "System." There are in it certainly a larger proportion of articles worthy of comparison with any that have been written in other languages.

The work, as a whole, is one of which the profession of the United States may feel justly proud. It marks a distinct era in the professional life of the country. In any work of this kind by various writers it was inevitable that there should be some feeble productions, but the average quality of the work is excellent, and the flaws which exist can be readily remedied when a second edition is issued. The rapidity with which the work has been issued is also a matter for congratulation, for the five volumes have appeared within two years and the entire time occupied since the conception of the scheme has been scarcely five years. It seems, too, most appropriate that the profession should offer to the publishers their congratulations on the completion of such an undertaking in the very year which celebrates the centennial of a house which has done more than any other in this country to supply standard medical literature.

The labors of an editor in supervising an undertaking of this kind are not seen in the pages, and the clerical work forms the lightest part of his duties. The chief difficulties have been encountered in the assignment of subjects to suitable men and in getting the work done in reasonable time, and without the skill, tact, and organizing capabilities of the Editor the profession would have probably waited many years for a System of Medicine by American authors.

THE PEDIGREE OF DISEASE, BEING SIX LECTURES ON TEMPERAMENT, IDIOSYNCRASY, AND DIATHESIS. Delivered in the Theatre of the Royal College of Surgeons, in the session of 1881. By JONATHAN HUTCHINSON, F.R.S., late Professor of Surgery and Pathology in the College; Emeritus Professor of Surgery in the London Hospital; President of the Ophthalmological Society, etc. 8vo. pp. 107. New York: William Wood & Company, 1885.

ANY work emanating from the pen of a writer so widely and favorably known as Mr. Hutchinson, is deserving of most careful study, and we shall endeavor to present such an abstract of his views as will fairly represent his position.

Mr. Hutchinson, we think, justly cautions against our utter repudiation of our forefathers' custom of prescribing "for a man's temperament," because the individual differences between man and man do exert important modifying influences upon disease. He then defines *temperament* "as the sum of the physical peculiarities of an individual, exclusive of all definite tendencies to disease." In other words, while temperament may impress some degree of peculiarity upon a disease, it does not involve any special proclivity to it. "When most strongly marked, temperament is still consistent with the prolonged enjoyment of perfect health." The author goes on to show that any distinct proclivity to a disease or series of diseases is a *diathesis*, which term he defines as "any bodily condition, however induced, in virtue of which the individual is, through a long period, or usually through the whole life, prone to suffer from some peculiar type of disease." Diathesis may be inherited or acquired; the effects may be permanent, transitory, or recurrent after intervals of health. Dyscrasia must not be confounded with diathesis, the former term signifying definitely bad health, while the latter indicates proclivity merely, and is applicable to an individual in robust health. Mr. Hutchinson makes the broad statement, that an inherited diathesis commonly latent at birth, may become aggravated, or in rarer instances be susceptible of cure in after-life, while the constitutional peculiarities which are termed temperament are not susceptible of any such alterations.

Mr. Hutchinson's definition of idiosyncrasy is, "any definite peculiarity of organization of which the consequences may occur unexpectedly and otherwise inexplicably." He also thinks that "it is quite possible that the idiosyncrasies may in many instances have sprung from the diatheses, yet they have become in long hereditary transmissions, questions rather of organization than of disease." After some preliminary

remarks on the difficulty of the study, the writer points out that in the study of temperament the observer must scrupulously reject everything which is the result of the influences to which the individual has been exposed. "That which has accrued to him during life goes to produce, or aggravate diathesis, but can do nothing in modification of temperament." After proving the inapplicability of the generally accepted data for the determination of temperament, because subject to alteration by time of life, state of health, etc., he sums up with this: "as to complexion itself, the further he"—the observer—"goes the more he will have to confess that, putting various conditions of sanguification aside as being in many persons dependent upon varying states of health, he can after all classify the complexions themselves only in reference to pigmentation." Mr. Hutchinson then goes on to state his belief, "that varying states of pigmentation of the integument denote rather exposure to climatic influences than peculiarities of development."

The emphasis laid upon the subject of complexion by the author, is because "almost all observers unconsciously trust" to this "in their endeavors to discriminate the temperaments in persons in good health." A classification by race, such as Celtic, Scandinavian, Roman, or English, is suggested as more valuable than their division by "certain more or less hypothetical vital tendencies." Speaking of the latest and best attempts at the classification of temperaments,—Dr. Laycock's—he points out that in reality his knowledge was more dependent on the recognition of diathesis than on the discrimination of temperaments.

After much correct argument proving the fallacies of so-called temperaments, the author says:

"The peculiarities which denote family and race must be viewed with the utmost caution" "by the physician in respect to tendencies to disease. They are usually of no use, and they may easily mislead. It is only indirectly that they may become valuable—that is, when the special proclivities of the race or family in question are known beforehand. A thick upper lip, when it occurs in a mulatto, denotes descent only, and not scrofula." While believing that "there are differences—mental, moral, and physical—between the fair and the dark, yet it would be extremely difficult to say anything definite as to what these differences are." "Thus then, I think, we may believe that in the English climate the abundance or comparative absence of pigment in the tissues does not, *per se*, make any appreciable difference in the vital endowment of the individual."

Noting briefly the most striking points remaining in this lecture, we find Mr. Hutchinson teaches that

"all marked deviations from the normal type should be held in some degree of suspicion. Thus, if the hair is markedly coarse, or unusually fine, if the skin be very thick or very transparent, we are perhaps justified in suspecting that there may be in other tissues similar departures from the average constitution, some of which may prove inconsistent with the preservation of perfect health."

These remarks are *à propos* of the other conditions usually included with differences in pigmentation in what is understood by complexion.

Lecture II. is occupied with the consideration of the most remarkable facts known with respect to idiosyncrasy. It is insisted that this term merely denotes our ignorance of causes without implying disbelief in their existence, and the belief is expressed that time will remove this ignorance, so that the results assigned to idiosyncrasy will be transferred

one by one to the domain of the several diatheses, concerning the causes of which something, at any rate, if not all, is known. Idiosyncrasies "are diatheses, or parts of diatheses, developed, intensified, and specialized by hereditary transmission." They are certainly due to structural peculiarities the author contends, and are congenital, although some indeed may be overcome, or modified as age advances. Howsoever peculiar some of them may be, there is usually to be noticed a certain reference to law and order.

The third lecture is entirely devoted to idiosyncrasy.

Mr. Hutchinson places himself squarely against the germ-theory of diphtheria and erysipelas when he says:

"Many persons will take them by contagion in whom other causes would have proved abortive. But both are capable of spontaneous origin, or, to speak more correctly, may be produced by exposure to certain non-specific influences, such as the ordinary causes of catarrh, injuries, sewer-gas, and some others. It is most important that all who value accurate classification should deny, both as regards erysipelas and diphtheria, their right to rank with those fevers which are due to specific animal poisons. With these, as it seems to me, neither of them has any real affinities. In both, I repeat, that with which we have to deal is a personal and inherited peculiarity, giving proclivity when certain exciting causes are brought to bear, to peculiar forms of inflammatory action. In both the disease is probably local at its origin; in both it spreads locally by the contagion of continuity of tissue, and in both constitutional symptoms result which are in some ratio with the extent and severity of the local action."

In Lecture IV. the author aims "to discover whether there exists any large group of states of personal peculiarity giving special proclivity to diseases which can be suitably defined and named." To facilitate this study of diathesis a rough classification of the causes of diathesis is suggested, the first being in relation to *climate*. The first considered is the "malarial diathesis," which "is probably in some degree hereditary, the inheritance being, we may suppose, in ratio with the severity and length of duration of the disease in the parent." Another, belonging to this group, is that which results in bronchocele and cretinism. Diet-diatheses are sometimes hereditary, sometimes acquired—*i. e.*, gout. Mr. Hutchinson, as is well known, considers that leprosy is due to a fish diet, but frankly admits that this theory is not as yet commonly admitted. Among the results of the gouty diathesis the author includes

"a large number of cases of crippling rheumatism, almost all those which are known as spondylitis deformans, a great majority of the cases of gonorrhœal rheumatism; most of the severe forms of neuralgia occurring to young persons, and many peculiar liabilities to hemorrhage."

Mr. Hutchinson, in Lecture V., considers malignant new growths with reference to diathesis.

We can here assure our readers that these lectures of Mr. Hutchinson will well repay the most careful study. They contain a mass of information, and of facts drawn from an unusual personal experience in many special fields of surgical practice, such as falls to the lot of few men. It is only exceptionally that a man becomes an authority in so many branches of our profession, and for that very reason the conclusions he draws from such varied experience should receive the most careful and respectful attention, however much they may run counter to our own impressions, which must, of necessity, have been founded upon far fewer data.

C. B. N.

THE ANATOMY OF THE INTESTINAL CANAL AND PERITONEUM IN MAN.
THE HUNTERIAN LECTURES FOR 1885. By FREDERICK TREVES, F.R.C.S.
4to. antique, vellum, pp. 66, pl. iv. London: H. K. Lewis, 1885.

WE owe Mr. Treves an apology for so late a notice of his book. But, as though to atone for our tardiness, our welcome of the excellent work shall be even more than hearty. Our copy is really an *édition de luxe*, worthy of the author and publisher, and especially of the place and subject. John Hunter himself would feel honored by a brochure of such elegance and worth. We have noted a number of valuable facts observed, to some of which we will call attention.

Physicians certainly do not appreciate the process of growth of the intestine in infants. Hidden in the belly cavity, its silent but incessant activity is not appreciated. At birth the small intestine measures nine feet five inches in length. In the first thirty days of extrauterine life the growth is actually two feet or nearly one inch *per diem*, and the second month witnesses a similar growth. After that time the rate varies much. What a lesson this should teach doctors and mothers as to the simplicity, and regularity, and quality of the diet. With two such factors as this rapid growth and extraordinary functional activity in digestion, the dangers arising from indiscreet food are magnified four-fold. Indeed, the rapidity of growth of the entire body in the first year is far more than at any other period in life; almost eight inches are added to the length of the entire body and the intestine nearly doubles its length.

Mr. Treves next calls attention to the "*plica and fossa duodeno-jejunalis*," a fossa formed by a fold of serous membrane passing from the parietal peritoneum to the duodenum and the seat of retroperitoneal hernia, of which already nearly fifty examples are recorded. The careful description and multiple drawings of this fossa and fold are an excellent contribution to anatomy.

The position and relations of the small intestine and right half of the colon are very different in the fœtus and the adult. At first they have a common mesentery and consist of a simple loop supplied by the superior mesenteric artery. By a semi-rotation the colon crosses over the duodenum to reach the right hypochondrium, but the caput coli is as yet just under the then large liver and practically no vertical ascending colon and hepatic flexure exist. Gradually, as the liver shrinks, the cæcum sinks into its normal position, the oblique colon assumes its vertical and transverse positions as ascending and transverse colon, and the adult phase is established. This history explains not a few important practical points. Thus the cæcum is usually entirely covered by peritoneum and has no meso-cæcum; it lies on the psoas muscles and not the iliacus, and not seldom projects over or even falls into the pelvis; in eighteen per cent. of the cases it lay entirely within that cavity. With such a freely movable cæcum it is not suprising that it sometimes occupies the hernial sac—indeed, it is suprising that it does not protrude more frequently. So movable is it that in eleven per cent. the cæcum could be made to touch the liver and the left side of the pelvis, and in several cases it could be drawn down to the level of the great trochanter.

As Mr. Treves points out, it is an anatomical impossibility in inflamma-

tory conditions of the cæcum to open the belly through the loin and reach the cæcum without opening the peritoneal cavity. Moreover, in a few cases the cæcum never does descend into its proper place, and in these cases there is no ascending colon—a fact not to be forgotten by the surgeon when considering the question of right lumbar colotomy, as already pointed out by Mr. Lockwood.

Mr. Treves's methods of study were excellent and painstaking. His book is based on the examination of one hundred bodies of those dying without known abdominal complications and each part was drawn *in situ* and later studied in detail. One method that bore but little fruit, but which shows the minute care he bestowed on his work—a model and a stimulus to many of our younger anatomists—was, on opening the belly, to attach a numbered brass tag to each coil of intestine, and later to study the position in the belly and distance from the pylorus of each tag, so as to establish (if any existed) the constant position in the belly of any particular part of the bowel. No such localization could be made out—a negative fact itself of value as precluding hereafter fanciful diagnosis based on such an assumption. Another practical point is the study of what coils of intestine occupy the pelvis. In the fœtus there are none, but they appear there soon after birth. Usually the impression is that only coils of the ileum occupy the pelvis, but Mr. Treves shows that that part of the intestine which has the longest mesentery—the part between two points, six and eleven feet from the duodenum—is not uncommonly found there. In two cases very nearly *all* the small intestine was found in the pelvis. And it is not uncommon to find the apex of a V- or U- shaped transverse colon in the pelvis. The bearing of these points in many cases of pelvic surgery and medicine is evident.

The sigmoid flexure seems to be a myth that Mr. Treves would sweep away, though we confess that his Fig. 21 A seems to justify the name at least. His iconoclasm is such that he says “the flexure does not occupy the iliac fossa, its mesocolon does not arise wholly from that fossa, its course is not that of either the letter S or the letter Σ , and the first part of the rectum is not disposed in the manner familiarly described.” Most of our readers, we venture to think, in introducing a long tube by the rectum, after reaching the upper end of the rectum would direct the tip toward the left iliac fossa and endeavor to worm through an S-shaped gut in order to reach the descending colon. Mr. Treves describes and figures the bowel thus: Starting from the end of the descending colon the bowel crosses the psoas muscles, dips into the pelvis, then forms a loop to the right reaching as far as the right border of the pelvis and then descends to the third piece of the sacrum, where it loses its peritoneal covering, and properly becomes the rectum. The flexure in the fœtus and child is rather omega-shaped than like any other letter, and the flexure and the first part of the rectum, as usually described, form one curve of an average length in the adult of seventeen and one-half inches. He proposes, therefore, to limit the term rectum to that part of the bowel from the third piece of the sacrum to the anus; and, we think justly.

We have not alluded to several other points we had noted in a careful reading of this very interesting and practical book. It shows again—and the lesson cannot be too often repeated—that even in these later anatomical days a careful study of even the gross anatomy of any

part of the body will well repay the time and labor bestowed, eliciting unknown facts, correcting unsuspected errors, and adding materially to the fame of the student himself. We regret not a little that, when studying so carefully the anatomy of the bowel, he did not investigate the *capacity* of the colon, with a view to determining the proper amount of fluid that could be injected. In "high injections" we often have injected nearly a gallon before any material pain was produced: but whether the whole colon was then filled or not, we are in great doubt.

W. W. K.

THE REFRACTION AND ACCOMMODATION OF THE EYE, AND THEIR ANOMALIES. By E. LANDOLT, M.D., Paris. Translated under the Author's supervision, by C. M. CULVER, M.A., M.D., Albany, N. Y. Octavo pp. xi, 600, with 147 illustrations. Edinburgh: Young J. Pentland, 1886.

It would be difficult to consider this book without, to some extent, comparing it with the treatise of Donders. Though they are separated by a period of over twenty years, no work attempting the same combination of physics, physiology, and clinical experience, has appeared in the interval. Both deal with the same subjects, approaching them from similar points of view, both works were well written and have been very well translated; on most points they are equally clear for the student, equally safe for the practitioner. But, while the former was a recasting of the knowledge of the time, and a revelation of new fields for investigation and practice, the later work is little more than restatement of principles and facts well and generally understood, and confirmed by many observers. Indeed, what strikes one most forcibly on reading Landolt's good presentation of the present state of knowledge and practice in this direction, is the idea that it has taken the better informed and more enterprising part of the profession all this time to come to a full appreciation of what Donders taught; and there is a lingering suspicion that the appreciation is not yet complete.

The volume is divided into three parts, a "physical," a "theoretical," and a "clinical" portion. The first of these, the author says, "is specially devoted to those who take a particular interest in the scientific solution of the questions under consideration;" and "it is hoped, that the first chapter will enable the reader to dispense with other books on physics, as far as concerns the resolution of the most essential problems in ocular optics."

It does not take up all possible problems that might be considered in this connection; but, giving abundant references for the more abstruse and less practical, it sets forth in one hundred pages of clear, brief, rigorous, mathematical statement, the demonstrations of primary importance. For the thoroughly prepared student, this portion constitutes an admirably well-written text-book. But its easy understanding requires, at least, a very thorough training in elementary mathematics. The author says: "its perusal, however, may be entirely omitted; the reader may begin with the second chapter, in and after which he will find no formulæ, and yet will easily understand the meaning of the text." This seems com-

forting to the man who has forgotten his algebra, or who never penetrated geometry much beyond the *pons asinorum*. But, when he begins with the second chapter, he will be speedily undeceived. Such expressions as " $f'' = \frac{f' F''}{f' - F''}$ " with numerous references to the first chapter, the

development of tables for axial and curvature ametropia, the consideration of the amplitudes of accommodation and convergence, are calculated to suggest to him the idea that he who attempts ophthalmology without mastering its physical and mathematical basis, consents beforehand to the inferiority of superficial knowledge, and imitative and routine practice. This is an idea that many who intend to "make a specialty of eye diseases" would do well to ponder. In so far then as this arrangement of the book is an attempt to evade the laws of mental development, that the ignorant may have the advantages of knowledge, and the untrained be able to grapple with difficult mathematical conceptions, it is a failure. In a sense it may be true that the later chapters "form an elementary manual on refraction and accommodation, stripped of analyses and formulæ." But he who needs to have his manual so stripped, will find works better suited to his understanding already in the market.

Chapter II., opening the theoretical portion, is headed "The Refraction of the Eye," but it also contains a consideration of the accommodation ("dynamic refraction"), and convergence, and of the relations of accommodation and convergence. We note here a clear explanation of what the author designates as the angle *alpha*; but regret that he applies the name to "*the angle formed by the line of vision with the major axis of the corneal ellipse*," instead of giving it to "*the angle formed by the optical axis and the visual axis*" (line of vision?), as he did in his *Manual of Examination of the Eyes*, and as almost all other writers on the subject have done. Undoubtedly there has been some confusion as to the angle *alpha*, and especially as to methods of measuring it. But it does not help matters to propose an entirely new angle to be so designated, even though it does not, in practice, materially differ from the one already known by that name. This chapter also gives an excellent explanation of the metre-angle which will be further referred to presently.

Chapter III., which deals with the "Methods of Determination of the Refraction and Accommodation of the Eye," gives a good description of the common method with test-lenses and test-types. There is also an excellent exposition of the principles upon which the various forms of optometers and other methods of determining refraction are based.

The description of retinoscopy seems to be drawn from reading rather than experience; and there is an allusion to "those who avail themselves of this kind of optometry," which indicates that the author is not one of them. Still he is able to propose another new name for this much-named procedure—"koroscopy;" which is simply "pupilloscopy" with a Greek, instead of a Latin root, to combine with the Greek terminal. Worse yet, he continues to use the old name, as well as the new, throughout the description of it.

The general plan of the book is violated to bring all reference to astigmatism into Chapter IV.; where, in less than forty pages, it is considered with a brevity entirely disproportioned to the general scale of the work. The chapter might do for a small student's manual, except

that the practical portion of it is so meagre and so unsound. Against more than a hundred pages devoted to developing the theory of spherical refraction, there is not a line of description of a cylindrical lens. The Stokes lens is not alluded to. The principal meridians in regular astigmatism, we are told, "are generally (sic) perpendicular to each other." By "koroscopy," "one may succeed even (sic) in ascertaining the *direction of the principal meridians*." After getting some insight into the author's imperfect appreciation of the subject, it scarcely surprises us to read: "We very seldom have recourse to atropization for the determination of astigmatism."

The "clinical" portion, so-called, embracing some two hundred and fifty pages, shows the writer to be more theorist than clinician. This is less of a disqualification here than it would be in any other department of medicine; but, even here, it causes serious omissions. For instance, we find no hint of the possibility of a connection between eye strain, and chronic, or recurrent acute, conjunctivitis, and blepharitis.

But justice has been done to the defects of the work; let us turn again to its good points. Among these are its treatment of the effect of spectacle lenses upon convergence, and on the fitting of spectacle frames to the face of the patient. As to the latter, we quote: "This question is generally too much neglected by the practitioner, as if the slightest detail in the execution of his orders were not of the highest importance for the patient." Of spectacle glasses: "One should test them when made, not alone from an optical point of view, but also from the point of view of their adaptation to the patient's face and to the conditions under which they are to be used." "If ophthalmology has made progress, industrial optics have done the same, and still more may be accomplished in this latter line, under the guidance of educated practitioners."

But it is Landolt's account of the *disorders of convergence* that the practical ophthalmic surgeon will find of most interest. His views on this subject are definite, clearly stated, and well illustrated by diagrams and clinical records. Moreover, they are, to some extent, new; and quite worthy of general attention.

If a pair of normal eyes look at some point directly in front of them, their visual axes will converge to meet at that point. Now calling the line joining the centres of rotation of the two eyes the *base line*, and drawing, from the point fixed, a perpendicular to the middle of the base line, the angle included between each visual axis and this perpendicular is the *angle of convergence*.

"The size of the angle of convergence depends, on the one hand, upon the length of the base line; on the other hand, upon the distance of the object. The base line having a constant value for each individual, we may regard the angle of convergence as depending solely upon the distance of the object. In proportion as this distance diminishes, the angle increases; the nearer the object approaches, the more convergence is required in order that it may be seen binocularly. Hence, we may say that *the angle of convergence is inversely proportional to the distance between the object fixed and each of the eyes*." "The unit is the angle of convergence necessary in order to fix simultaneously, with both eyes, an object situated on the median line, at a distance of one metre from each eye. We are indebted to Nagel for the ingenious idea of rendering the mensuration of convergence so simple, and, as we shall see, so practical. He calls this unit-angle the 'Meterwinkle,' *metre-angle*. We shall designate it as *ma*. Convergence is, in this way, easily expressed. If we have to do with an object one-fifth of a metre distant, we know that the converg-

ence requisite for binocular vision at this distance, is $\frac{1}{\frac{1}{5}} = 5\ ma$; for five metres we shall have $c = \frac{1}{5}\ ma$, and so forth."

It will be seen that the exact value of the unit, or metre angle, in degrees, varies in different persons directly with the base line or distance between the eyes; also, that its value increases slightly for the higher degrees of convergence. Tables showing its value for different base lines, and different degrees of convergence are given. But these variations are so slight that they may be disregarded in practice, and the metre angle assumed to have a constant value of one and three-quarter degrees, about the deviation produced by a prism with a refracting angle of three and one-half degrees.

"The *maximum of convergence* is the inverse of the distance between the nearest point (*punctum proximum of convergence*) which can be fixed binocularly, and each of the eyes." "The *minimum of convergence* is the inverse of the distance between the farthest point which can be fixed binocularly (*punctum remotum of convergence*), and each of the eyes." "The difference between these two values is the amplitude of convergence."

To determine the maximum of convergence, Landolt uses what he calls an *ophthalmo-dynamometer*. This presents a vertical line of light, which is pushed up toward the patient's eyes until, in spite of the greatest possible effort at convergence, it just begins to appear double; when its distance from either eye is read off from a tape-measure attached to it. To determine the minimum of convergence, it is commonly necessary to use prisms, for most people can not only render their visual axes parallel, but they can also cause them to diverge. The extent of this power of divergence is estimated by fixing the eyes on a distant object and ascertaining what strength of prism, with its base turned toward the median line, can be overcome and the object still seen single. When the visual axes diverge forward, they, of course, converge backward. Hence such divergence is spoken of as *negative convergence*. In a case where each visual axis diverged one and three-quarter degrees, from the perpendicular to the base line, the condition would be indicated by $c = -1\ ma$. If such a person had a maximum convergence of $9.5\ ma$, which Landolt states to be the average, the amplitude of convergence would be

$$9.5\ ma - (-1\ ma) = 10.5\ ma.$$

Having thus determined the amplitude of convergence, our author has undertaken to ascertain what proportion of this power is available for continuous use. He says:

"The experiments which I have made, with a view to furnishing the answer to this question, are of recent date and not yet as numerous as I could wish. They tend to show that the quota of convergence, which can be utilized for continuous work, ought not to amount to more than one-third, or even one-fourth of the positive convergence power; hence that two-thirds or three-fourths of the latter should be kept in reserve."

When the one-third or one-fourth of the maximum, available for constant work, is insufficient for the needs of the patient, recourse must be had to expedients for increasing it. In addition to those hygienic and medicinal agencies which tend to increase the power of the muscu-

lar and nervous systems in general; and the special exercise of the particular muscles in question by orthoptic training, prisms may be resorted to.

"But the use of prismatic spectacle glasses is limited. Besides the property of deflecting luminous rays, they possess others which are injurious to vision as soon as the prism reaches a certain strength; for instance, chromatic aberration, an apparent alteration of surface form, and seeming recession of the object looked at. Moreover, prisms, whose strength exceeds a few degrees, are so heavy that their use as spectacle glasses soon becomes burdensome. At all events, it is scarcely practicable to wear prisms of more than five degrees."

"Hence we must have recourse to *surgical methods*. Instead of compounding with the affection and laboring further with the inadequate muscular power, in the way of artificial deflection of rays, we shall augment the convergence power, and extend its province by operative means.

The activity of the adductors may be increased, in the first place, by lessening the strength of their antagonists, the abductors. This end is attained by tenotomy of one or both of the *recti externi*. On the other hand, the convergence may be strengthened by giving the muscles which preside over this function a more favorable point of action. This is accomplished by *advancement* of one or both of the *recti interni*. These then become inserted farther forward on the eyeball, nearer the cornea, and, moreover, in the process of cicatrization they undergo a certain amount of shortening. In this way their action on the rotation of the eyeball—*i. e.*, on convergence—is certainly strengthened, and the more so in proportion as the muscle has been brought further forward. Finally, we may combine both of these operations—advancement of the adductors, and tenotomy, or setting back of the abductors. In this way any desired degree of convergence can be obtained, provided that there does not exist a pathological weakness of the muscles or of their innervation. On the other hand, it may at times become a question as to whether or not the range of convergence will allow of the diminution, at the extremity of its *punctum remotum*, which will be produced by the operation. For it will readily be perceived that, by bringing the *punctum proximum* nearer, the risk is sometimes incurred of bringing the *punctum remotum* too near, through weakening of the abductors."

"However unpleasant it may be to commit a therapeutic error in the prescription of glasses, it is but seldom followed by serious consequences, especially when it is recognized in time and corrected. But it becomes quite another matter when it is a question of surgically affecting the muscular system of the eye, and, indeed, especially in the case under consideration, where there is a simple insufficiency of the muscles. The less considerable the motor disturbance, the more difficult and the more delicate is its surgical treatment."

In regard to the differentiation of the cases proper for surgical interference, the author says:

"Taking all in all, it is possible to distinguish two forms of motor asthenopia, which are distinctly separated from each other. The first we may designate *muscular asthenopia in the true sense of the word*. It depends upon the absolute or relative weakness of the adductors or upon their insertion. The second has its origin in the *central organ*, and depends upon a disturbance of innervation or upon a weakness of the power of fusion. The excursions of the eyes, the monocular fields of fixation, and the associated movements may with all this be quite normal, whilst the amplitude of convergence is much reduced, or even, at times, equal to zero."

In the first class brilliant results may be attained by operative interference; in the second it may cause temporary improvement, but in the end almost always proves unsatisfactory. Specific rules are not given for determining, in a given case, to which class it belongs or which

operative procedure is to be resorted to. But tenotomy of the externi seems indicated where, with deficient positive, there is an excess of negative, convergence; while cases in which there is marked lessening of the amplitude of convergence are better adapted to the advancement of one or both interni. Operation does not merely add to the positive convergence what it takes from the negative, bringing the whole range just so much nearer to the eye; but in good cases the gain is greater than the loss, so that the amplitude of convergence is actually increased. In one case cited, this increase was from 8 *ma* to 15.5 *ma*; in another, it was from 5.5 *ma* to 22 *ma*. Sometimes, however, gain and loss just balance, or in badly chosen (neurasthenic) cases the loss may be greater than the gain, and the patient the worse for the operation.

The author's method of recording these cases is simple and graphic, and is worthy of attention. The spaces between the parallel lines running across a page are taken as each representing a metre angle. The zero line is near the top of the page, and the negative convergence laid off upward, the positive downward. Then the case is recorded by simply drawing a straight vertical line extending over the spaces which represent its metre angles of convergence. In this way many cases, or many observations of the same case, may be recorded on one page and compared at a single glance.

As Landolt says: "We must confess that our knowledge as regards muscular asthenopia and insufficiency of convergence is still in its infancy." And it is to be hoped that his account of them will stimulate others to the recognition and study of these cases.

As our quotations would indicate, Dr. Culver, the translator, has done his work thoroughly and well. The volume is comparatively free from mistakes. Its execution places it in a small list of very finely made books that have recently been issued in Edinburgh. The diagrams are of peculiar excellence throughout. Of the three colored plates of the fundus, two are good; but the third if not labelled "normal" would leave one in doubt as to whether it was intended to represent a great hemorrhage in the region of the macula, or some hitherto undescribed anomaly.

E. J.

PRACTICAL HUMAN ANATOMY. A WORKING GUIDE FOR STUDENTS OF MEDICINE AND A READY REFERENCE FOR SURGEONS AND PHYSICIANS. By FANEUIL D. WEISSE, M.D. 8vo. pp. xii. 456, with 222 plates. New York: Wm. Wood & Co. London: Cassell & Co., 1886.

It is not often that we have had so much pleasure in looking over a new anatomical book. In every way this has pleased us. The good paper, large and clear type, make it delightful to read, a delight to which the text, as a rule, adds by its brevity and clearness, while the plates are a monument to the skill of Mr. Cohn.

It is an admirable dissecting-room guide. The directions are very clear and practical, the plates indicate excellently, as a rule, where the muscles, fasciæ, etc., should be divided to get at deeper parts (no small help to a beginner), and, except for its bulk, we should expect it to become the favorite cisatlantic Dissector's Manual.

Of the plates—and the book is half plates—more than half in bulk—we cannot speak too highly; we have carefully looked over nearly every one to find any errors and were baffled in our search (except that in our copy by an error in binding Plate 58 is left out altogether) till we got to the very last one, and there it was only in a name—"processus e cerebello ad testis." They are simply marvels of accuracy and elegance.

The author's style, however, lacks something, here and there, in accuracy in the use of words, which shows itself even in the sub-title, for there is no such substantive as "a Ready Reference." Thus, his constant use of "section" as a verb, in the imperative or other moods—*e.g.*, "section the superficial vessels," "a part is only to be sectioned at that stage," etc., cannot be justified. On page 9 he says: "The veins of the body are subcutaneous and comites." Not only is this a puzzling statement in its odd use of the Latin adjective, but it is erroneous as a classification, as, indeed, he immediately shows by saying "some of the deep veins are *not* comites. The venous channels (sinuses) within the cranium are not comites." How much better to have divided the veins into "superficial and deep," and then explained that "most of the deep veins are companion vessels ('venæ comites') to the arteries and run one on each side of them." Then, too, Lindley Murray would scarcely approve of the following sentence: "A body, dissected by eight, there will be two to the head and neck, etc."

We point out these minor faults that they may be corrected in later editions, for that later editions will be called for is certain. But in general, we may say that the text is nearly as free from errors as are the plates, and that the whole book is a credit to author, artist, and publishers.

W. W. K.

RECENT WORKS ON BACTERIOLOGY.

- I. THE METHODS OF BACTERIOLOGICAL INVESTIGATION. By DR. FERDINAND HUEPPE. Translated by HERMANN M. BIGGS, M.D. Illustrated by thirty-one woodcuts. 8vo. pp. 218. New York: D. Appleton & Co. London: Cassell & Co., 1886.
- II. DIE METHODEN DER BAKTERIEN-FORSCHUNG. Von DR. FERDINAND HUEPPE. Dritte, vermehrte und verbesserte Auflage mit 2 Tafeln in Farbendruck und 40 Holzschnitten. 8vo. S. viii. u. 244. Wiesbaden: C. W. Kriedel's Verlag, 1886.
- III. DIE PATHOLOGISCH-HISTOLOGISCHEN UND BACTERIOLOGISCHEN UNTERSUCHUNGSMETHODEN, MIT EINER DARSTELLUNG DER WICHTIGSTEN BACTERIEN. Von DR. KARL HUBER und DR. ARNO BREKER. Mit 13 Abbildungen im Text und 2 farbigen Tafeln. 8vo. S. viii. u. 122. Leipzig: J. C. W. Vogel, 1886.
- IV. NEUE UNTERSUCHUNGEN ÜBER DIE CHOLERA-MIKROBEN. Von DR. E. VAN ERMENGEN. MIT AUTORISATION DES VERFASSERS FREI BEARBEITET. Von DR. RICHARD KUKULA. Mit 6 Tafeln. 8vo. S. iv. 105. Wien: W. Braumüller, 1886.

THE translation of Hueppe's admirable work upon *The Methods of Bacteriological Investigation* was undertaken by Dr. Biggs for the benefit

of students in New York, and the completion of the work must have been of great advantage to those who were not able to have access to the original.

The book treats the subject in an exceedingly clear and comprehensive manner, and leaves little to be desired by the beginner, and is a complete guide to those wishing to work out any of the innumerable problems connected with the life-history of the bacteria. The author, before beginning his task at all, seems to have made an exhaustive study of all the work previously done in bacteriology, and has given in his manual only those methods which have borne the severe test of experience. The true saprophytic forms are first discussed, and the differences between pathogenic and non-pathogenic bacteria are made clear.

The various methods of preparing bacteria for the microscope and of obtaining pure cultures of these organisms are given at length, inoculation experiments for the determination of the causal relation of bacterial growth to decomposition and disease are treated of, the general biological problems involved are mentioned, and, of course, the special investigation of earth, air, and water. The book is brought to a close by a concise and complete statement of the necessity of making bacteriology an object of instruction—a necessity which very few medical men care to deny at the present time.

Written by a pupil of Koch's, this book naturally gives very great prominence to the views of this leader, and his methods are those which are treated of in particular. It would be difficult, however, for a more impartial statement of all sides of the controversy as to methods to be made, and, inasmuch as Koch's work is the best, and his methods the most accurate that have as yet been suggested, it cannot be said that they have received an undeserved prominence. The translation seems to be well done.

In the preface to the translation just spoken of, it is implied that the work was done with Dr. Hueppe's approval, and it is to be regretted that the translation was not delayed a little longer, for the reason that almost on the day when the translation reached us we received from Wiesbaden a copy of the third edition of the original. This third edition contains much new and valuable material, which should have been included in the American reprint, and doubtless will be so included upon the issue of a new American edition. The new material embodied in the original includes a very good description of Fol's methods for the protection of sterilized fluids from contamination—given in full in *La Nature*, No. 619, 1885—some of which are well worth attention and adoption, and a description with figures of Chamberland's unglazed porcelain filters. Thus far, these filters seem to be the only ones which are actually bacteria-proof for any length of time, thus permitting fluids to be freed from bacteria—sterilized without heating. There are many minor additions scattered through the book, and it may fairly be said that there is not in existence a more complete manual for the student in bacteriology than this third edition of Hueppe's work. The rapid advances in technique will make necessary something still more freshly revised in the near future.

The little book by Huber and Breker is of a different style and complementary to that of Hueppe. It is an abstract from Birch-Hirschfeld's *Pathological Anatomy*, and is likely to be of very great service to the bacteriologist. The authors have divided their labors and their book

into two distinct parts: the first, by Dr. Huber, being devoted to the microscopic technique; the second, by Dr. Breker, to a short description of culture methods, and a full classification of all the described varieties of bacteria. In both cases the work is well done, but that portion of it which seems to be of the greatest use to the investigator is the second half, which contains descriptions of nearly eighty varieties of bacteria, with references to the original monographs. These references might occasionally be more definite, but in all cases they are sufficient to enable one to discover the original work without any great difficulty. A very valuable addition to the work is a double-page lithograph, containing thirty-eight figures in colors, showing the appearances under cultivation, and in different media of a number of the most important bacteria. In most cases these figures represent the originals with a very considerable degree of accuracy, and the plate is certainly one which may be studied with advantage, and would even be worthy of framing for the walls of a bacteriological laboratory.

The very best, and in every way most complete, monograph upon the bacteria of cholera which has yet appeared is that of van Ermengen, published last year. We are very glad, indeed, to note that its merits have been sufficiently acknowledged to permit the appearance of this translation into German, and wish that it had also been brought out in English. The illustrations accompanying the original, and this translation also, are triumphs of the method by which they were made. H. C. E.

DISEASES OF THE TONGUE. By HENRY T. BUTLIN, F.R.C.S., Assistant Surgeon and Demonstrator of Practical Surgery and Diseases of the Larynx in St. Bartholomew's Hospital, lately Erasmus Wilson Professor of Pathology at the Royal College of Surgeons. 12mo. pp. 451. Illustrated with chromo-lithographs and engravings. Philadelphia: Lea Brothers & Co. London: Cassell & Co., 1886.

THIS work is stated to be an encyclopedic treatise upon the diseases of the tongue, and a careful examination of its contents justifies the claim, for in it are described all the ailments of this unruly member, it matters not how trivial they may be.

After a brief introductory chapter, the accidents to the tongue are considered, such as burns and scalds, stings and bites, wounds and foreign bodies. A schematic classification of the different morbid appearances of the tongue when various corrosive liquids have come in contact with it is given, and will prove of value. Corrosive sublimate is stated to produce a very characteristic appearance, the tongue becoming white and shrivelled, and the papillæ at the base greatly enlarged, whilst sulphuric acid causes the organ to become white and glazed, and nitric acid renders it swollen and citron colored. Wounds of the tongue heal very readily, and are to be treated upon exactly the same principles as wounds of the soft parts elsewhere. One would think this advice to be superfluous, but that this is not the case is well illustrated in the case of a young lady who was recently under our professional care. She had

bitten her tongue severely in childhood, and in response to inquiries of the mother, the attending physician said it was not necessary to sew it, as it would not prevent her from getting a husband. She has to this day a deformity of the tongue which is very noticeable, and which a few sutures would have obviated.

Anomalies of the tongue are rare, and there is but one authentic case on record of its complete congenital absence, that of Jussieu, reported in 1718. Speech was but little affected by this malformation, but mastication and deglutition were difficult owing to the collection of food around the teeth and between the cheeks and teeth. Bifidity of the tongue also occurs occasionally as a congenital deformity.

Most practitioners will agree with the author in the statement that the frænum is divided frequently, when there is no necessity for doing so. Too great length of the frænum sometimes allows the tongue to slip backward and so interfere with respiration; this condition is known as tongue swallowing, and three cases were related by Petit as far back as 1742, in two of which death resulted from the impaction of the tongue in the pharynx. Other cases have been reported by different authors, and the affection whilst usually occurring in infants sometimes affects adults; thus Dr. R. H. Thomas, of Baltimore, reports in *The Medical News*, of August 19, 1884, the case of a young lady in whom there was an acute spasmodic attack of retraction of the tongue with suffocative symptoms. A case of extreme mobility of the tongue is also well known to us in the person of a physician, who can, at will, turn his tongue backward to such an extent as to put its tip into the pharynx behind the uvula.

Passing over the discolorations of the tongue, some of which, as the "black tongue," defy etiological explanation, we note the chapter upon "Inflammation of the Tongue." Acute glossitis is admitted to be an exceedingly rare disease, but one which has been accurately described, and which can scarcely fail to be recognized by the pain in the organ, difficulty in mastication, and rapid increase in size. Mild cases may be treated by astringents, ice, or leeches; but when the symptoms are severe incisions should be made deeply into the substance of the organ. Under this treatment the swelling rapidly subsides, suppuration is prevented, and convalescence is rapidly established. Hemiglossitis is an even rarer affection than inflammation of the whole organ, and usually subsides promptly under mild general and local treatment. It is remarkable that a part which is so exposed to irritation of various kinds, should be so exempt from inflammatory diseases.

Eruptions, indentations, excoriations, furrows, and fissures of the tongue are described, and figured in colored plates, which, though not masterpieces of art, show the conditions with tolerable accuracy. The subject of ulcers is pretty thoroughly exhausted in Chapter VIII. Many of the lingual ulcers are of traumatic origin, others dyspeptic, or due to gastric derangements, whilst syphilis in all of its stages furnishes examples. The tuberculous ulcer, whilst rare, is sufficiently recognized, and the suggestion is made to remove it, both to lessen local irritation and to prevent contamination of the system. The author even advises the removal of secondary tuberculous ulcers, if it can be done readily, in order to relieve the grievous local distress. Lupus of the tongue has been seen only a few times.

Tumors of the tongue form an interesting and important contribution to the work; those of a benign nature are rare, but are occasionally met

with, especially the fatty, fibrous, and telangiectatic. Sarcoma of the tongue has been seen but a few times, but epithelioma of the squamous type is sufficiently common, and is at this time especially held in remembrance on account of the recent case of General Grant, and more lately that of Mr. Wakley, editor of the *Lancet*. Cancer of the tongue is much more frequent in males than in females, which is to be expected, as men are exposed to the various exciting causes more than women. Mr. Butlin lays especial emphasis upon the danger of cauterizing the tongue. He says: "*If there be one thing more harmful than another in the treatment of simple indolent sores of the tongue in persons over thirty years of age, it is the application of a strong caustic.*" All warty growths upon the tongue should be removed as a prophylactic. When there is a suspicious surface upon the tongue, the scrapings should be examined microscopically, for if it is tuberculous it may be possible to find bacilli, and if cancerous distorted epithelium will be discovered. The author says, in regard to the prognosis of cancer, that "patients who are not operated on usually die within a year or eighteen months from the first appearance of the disease," and that "it may be taken for granted that a saving of 10 lives in 100 may be fairly claimed for operation in cases of lingual carcinoma." Nevertheless cancer of the tongue is one of the most malignant of all affections.

The different methods of removal of the tongue are thoroughly described, and a special chapter is devoted to the "choice of an operation." In this chapter are given the author's personal opinions as to the relative merits of different operative procedures. He says there are but few lingual carcinomata which cannot be removed through the mouth, and that there does not seem to be much difference in the rates of mortality of the different operations; personally he prefers Baker's method with the *écraseur*, or Whitehead's method with scissors in uncomplicated cases, whilst in complicated cases, one of the submental methods, as Kocher's, may be employed.

The final chapters are devoted to parasitic diseases and nervous affections of the tongue. In conclusion, we commend the work to the favorable consideration of our professional brethren, and would say to them, if there is anything you wish to learn about diseases of the tongue, read Butlin's book.

R. W.

TRAITÉ PRATIQUE ET DESCRIPTIF DES MALADIES DE LA PEAU. Par ALFRED HARDY, Professeur de clinique médicale à la Faculté de médecine de Paris, médecin de l'hôpital de la Charité, etc. 1 volume in 8vo de 1240 pages. Paris: Librairie J. B. Ballière et fils, 1886.

A PRACTICAL AND DESCRIPTIVE TREATISE ON DISEASES OF THE SKIN. By PROF. ALFRED HARDY.

A REVISION of this book as a whole, by summing up the special points of each chapter individually, gives one, as the chief common factor, the fixed idea of a diathesis, hereditary or acquired, as the fundamental cause of all diseases of the skin. This conception, arising from the tendency to generalization and theory natural to the French, and brilliant rather than scientific, originated with Alibert; and was sustained, after

his peculiar fashion, by Bazin. Hardy has never quite eliminated himself from the shackles forged by his predecessors and teachers. He represents the antiquated French school, and, were he less of a man, would represent that only. But a certain stubborn independence of character, and a temperamental nervous impatience of restraint, enable him, Janus-like, to present a face of recognition to the coming light while he yet turns another longingly backward toward the dark past. He admits tacitly the influence of Hebra upon modern French thought, as exemplified in the teachings of Vidal and Besnier, while a narrow pseudo-patriotism prevents him from subordinating theories, which are French, to science, which is only cosmopolitan. The light thrown upon obscure points of dermatology by modern histological investigation, is naturally somewhat dazzling to one whom we have seen make his diagnoses in dark basements by the aid of a single candle.

Hardy, furthermore, claims the credit of having been, with Bazin, the leader in establishing, pathologically, the doctrine of parasitism in skin diseases, and thus pointing the way to the discovery of the numerous morbid microorganisms of the present day, all of which he would place in the same category as the fungi of favus and of tinea. But Hardy, after all, merely followed the lead of Bazin; and all that even Bazin did, as original work, was to locate upon the hairless skin, as tinea circinata, in 1854, the trichophyton discovered by Gruby, in 1842, and described by Malmsten, in 1846, as trichophyton tonsurans of the scalp. The microsporon furfur of tinea versicolor was discovered in 1846 by Eichstedt, while the achorion of favus was discovered by Schönlein in 1839. We cannot then concede much originality to Hardy as a discoverer, even were we ready to admit his statement that bacilli *et id genus omne*, are only mushrooms.

And yet, when all this has been said, this volume remains the best work upon cutaneous diseases which has, as yet, appeared under French auspices. It is, however, a work for the library of the specialist rather than for that of the general physician. It is too diffuse, and based upon clinical, rather than upon pathological, observation. Quite comprehensive, and well arranged, therefore, though it be, so far as regards the consideration of external appearances, it necessarily considers many conditions which are purely symptomatic, trivial, and fugitive, and which cannot be regarded as true lesions of the skin; while, on the other hand, it lacks all mention of some of the important cutaneous maladies recently observed and differentiated from those previously recognized. Hardy poses as a specialist, but the aim of the specialist should be to condense, by elimination of the superfluous; intension rather than extension, quality rather than quantity.

In a work so clinical in its nature as this one is, we should expect treatment to be a strong point. From a believer in the constitutional nature of skin diseases we should expect to find stress laid upon internal treatment. And yet, when giving the treatment for ichthyosis, the author says "every internal remedy is useless and possibly harmful." Still, there are many valuable suggestions for treatment, which, we are pleased to see, are general, the book being entirely free from stereotyped formulæ and universal panaceas for the misuse of practitioners and the detriment of their patients.

A just criticism might perhaps be made that the author hardly shows sufficient acquaintance with the work of other laborers in the same field

at the present time, and has devoted too much time to attacking ancient views long since exploded and best at present entirely relegated to well-deserved oblivion. It is hardly necessary to-day to devote several pages to proving that *rupia* is not *ecthyma*. One regrets also to notice that the distinction between *prurigo*, a disease, and *pruritus*, a symptom, is by no means properly drawn and insisted upon.

The chapters upon deformities, or rather blemishes, of the skin is, because clinical, too extended; that upon the neuroses, on the contrary, is far too restricted in its scope. The family of the *scrofulodermata* is made the scapegoat for multifarious ills of the skin, a sort of dermatological cesspool. The chapters upon syphilis, on the contrary, are full, and the subject very generally treated of, as should always be the case in all works upon skin diseases.

While, therefore, considering the number of good treatises upon diseases of the skin, in the English language, we can hardly recommend this book to the general English-speaking medical public, it must be said that this is merely a relative condemnation. We are glad the book has been written; we feel that it will do good work in France; and it is cheering to see the Bourbon aspect of French dermatology at last undergoing some change and the specialty itself making progress.

E. W.

CLINICAL DIAGNOSIS: A HANDBOOK FOR STUDENTS AND PRACTITIONERS OF MEDICINE. By JAMES FINLAYSON, M.D., Physician and Lecturer on Clinical Medicine in the Glasgow Western Infirmary. Second edition. London: Smith, Elder & Co. Philadelphia: Lea Brothers & Co., 1886.

THE main interest in a new edition of a clinical manual is less in the amount of new matter which is incorporated, than in the fact that the material and the form in which it is presented give indications of the tendency of modern teaching, and, therefore, of the direction in which the study of medicine is progressing. In comparing this edition with the first, published eight years ago, a marked advance is evident. Not only has our knowledge increased largely by the accumulation of facts, but the methods of investigation and examination have improved. With this we find a clearer definition of terms, and a growing determination to rely more on facts and leave less to theory.

There is still in the profession a certain vagueness or looseness of expression, sometimes covering want of knowledge, sometimes used to lull the anxiety of friends whose confidence is increased by the nominal or apparent recognition of the ailment. This remnant of mediæval mysticism is in direct antagonism to the whole tendency of modern science in every branch. Why call a dyspeptic headache the result of "bile flowing to the brain," in deference to the ignorance of a patient who ascribes all indigestion to the liver; or state to the inquiring friends that a "wave of depression" is passing over the patient? Persons are naturally desirous to know what ailment a friend is suffering from, and are generally most easily satisfied by a term they can repeat, however little may be its signification. Where no definite name is reserved for the condition we are asked about, we are left to choose between a meaning-

less phrase, or an explanation of the state of the patient. The latter requires a more exact diagnosis and is thus rendered the more difficult.

Exactitude in diagnosis is evidently considered by some practitioners no part of their duty, but to be the exclusive business of the consultant; perhaps excess of work makes more than empirical treatment by them impossible. In such rapid practice, all that can be attempted is such diagnosis as results from noticing the appearance of the patient, and the state of his tongue and pulse; aided by such a history of the attack as can be furnished by the patient or his friends in a few minutes.

The faculty of rapidly grasping the significance of the aspect of the patient or his position—in other words, a knowledge of the physiognomy of disease—is important to every one; but any indications received in this way should receive confirmation from exact methods of examination before being accepted. This manual shows a just appreciation of the relative values of physiognomy and systematic examination in that it devotes the first chapter to the former, and then proceeds to give full instructions for an exact investigation of the condition of the various organs and functions. In this first chapter, written by Professor Gairdner, all the elements for a rapid guess at diagnosis are set forth, but with due warning that they are useless by themselves. The writer says:

“What the clinical observer has to do is not to grasp at a hasty generalization, but to note details of positive fact, and out of these to evolve the elements of a sure diagnosis. The statement that the patient has some peculiar and specific constitutional morbid tendency or bias is not, in any case, the statement of a fact, but of an opinion, and sometimes of a very insecure and fanciful opinion.”

As the method of systematic investigation necessary for reliable diagnosis demands closer application and longer practice than are requisite for the learning of a few “tips,” the student is liable to be turned from the proper study of the one by the alluring simplicity of the other. As Professor Gairdner remarks:

“The popular, and to a certain extent the half-educated, medical mind is always looking for a pathognomic sign, or a broad, striking, easy generalization from a few facts; whereas, it is only by ripened experience that we come to know gradually the real value of common and obvious, still more, of uncommon, and not obvious, facts *when seen in combination*, so as to form conjointly a basis for large inferences.”

Nothing is so harmful to students as the practice, not yet obsolete amongst clinical teachers, of indicating the easy roads to diagnosis, prognosis, and even treatment, by the appearance of the tongue or the feel of the pulse. To the beginner, there is much that is attractive and seductive in a method that seems to give, in a few minutes, an insight into all that is worth knowing about a case; but when the student has developed into the practitioner, and is left without the physician's notes to aid his own observation, he finds his tips fail him sadly. The clinical instruction that in each case begins with the fact that the patient looks ill—always of first importance, though an apparent truism when the lecture is on a case of pneumonia in a hospital ward—and goes systematically through all signs and symptoms till at length a reliable diagnosis is reached, lays the foundation for a feeling of self-reliance which is invaluable in after-practice. The student may perhaps tire with the long enumeration of facts before the climax of diagnosis is reached, and

may consider the lecture tedious; the busy practitioner, a year or two afterward, would give much for an opportunity of hearing these same lectures again.

The clinical observer has to exercise the functions of counsel, judge, and jury in one. Facts that are apparent have to be noted, those hidden or disguised have to be elicited, the essentials sifted from the unimportant, and the whole arranged with due significance attached to each: then with all the facts collected and arranged before the mind, and as the result of a "summing up" guided by past experience, a decision has to be arrived at and delivered as diagnosis, prognosis, and treatment. Clinical instruction should be directed toward helping the student to approach every fresh case with this object, and teaching him the means of collecting and arranging his facts. This is the plan of the present manual. It "does not aim at supplying any short and easy road to medical diagnosis; its object is to guide the student to a careful examination of the symptoms in his patient, and to supply information as to the methods and results of clinical investigation." In order to carry out this intention in the fullest manner, Dr. Finlayson has obtained the coöperation of certain specialists, who treat of their own subjects, viz.: insanity, gynecology, and the examination of the fauces, larynx, and nares.

Here again we have another sign of the immense strides medical knowledge has taken of late years. Special knowledge is now required for almost every organ, and no one man is able to master, and so to teach efficiently, every branch of medicine. Thus arises the demand for specialists; but just as a general knowledge is requisite in the specialist, so must the student study every branch of his profession. This division of work has many advantages, but it has also some disadvantages. The specialist is apt to attach undue importance to his own branch, to the extent, it may be, of slighting other equally important divisions of medicine. This fault shows itself to some extent in the present work.

The importance of including a study of insanity among the essential parts of a medical education is now fully recognized. There is, however, in the chapter on "Insanity" in this manual too great a tendency to make all peculiarities into forms of madness—a sort of authoritative confirmation of the saying that everyone is mad on some point. In a work devoted entirely to brain disease we are not surprised if every peculiarity of individuals is made to point to a moral: but in a student's manual of general medicine this gives the subject an undue prominence. *Astraphobia* and *syphilophobia* etc., sound unnecessarily serious when classed under the heading of "Partial Emotional Insanity." So too in the chapter devoted to the "Female Generative Organs," we find several common dyspeptic symptoms referred to uterine derangements, which are frequently associated with the latter, but the amelioration of which depends on no special uterine treatment.

The plan of the work is well followed out, and it is evident that the manual has undergone a very thorough revision in this edition. Many sections are entirely rewritten and much new matter is introduced, with the result of bringing the work up to date. Many new plates have also been added, some of them specially drawn for this book. The Appendix to Chapter I., on "Weights and Heights," is new and useful; as is also the paragraph on "Occupations Injurious to Health," on page 62. Twelve pages are devoted to "Febrile Rashes" in which measles, small-

pox, scarlet and enteric fevers are discussed. Tables are given for the time when the rash appears, for the incubation period of each, and of the liability to second attacks. Under the last heading we note that while one attack of enteric fever is barely allowed to be protective against a recurrence, the power of scarlet fever in this respect is overestimated. The other two tables lack the precision of which they are capable, and which would render both points of value for purposes of diagnosis and of hygiene. The incubation periods seem, in some cases, to be calculated from the appearance of the eruption as in that of smallpox and measles; in others, as in scarlet fever, from the beginning of the illness; we are left in doubt as to whether enteric fever and typhus are estimated by the former or the latter method or both in different ways. We are glad to see in the first of these tables, that the time for the eruption of varicella is given as the first day of fever; it might have been added that the first febrile symptoms are sometimes markedly severe. The rash of German measles should have been fixed for the second day—that is, the day following the first febrile disturbance. Where this has extended to the fourth day, measles may be suspected. The rash of septicæmia has not been mentioned among those that may simulate scarlet fever. The various roseolæ are well described and the rose spots found in cerebro-spinal fever are noticed.

In the scheme for Case-taking the omission to note the date—day of week and month—on which the patient sought relief is an oversight: the length of time the patient has followed his occupation might be included. In the respiratory system, hæmoptysis should have special mention.

As might have been expected from the rapid advance in the study of nervous diseases in the last ten years, and the greater exactness of observation which is now required in examining these cases, we find a large addition to the length of the chapter on "Nervous Diseases," which has grown from forty-seven to seventy-one pages. The section on "Reflexes" is added and makes the chapter more complete. We notice that hysterical paralysis is only just hinted at. It is rather a sign of the prominence given at the present day to nervous diseases that the chapters devoted to this branch, including the organs of special sense, fill almost as many pages as are devoted to the respiratory, circulatory, digestive, and urinary organs together.

The use of the sphygmograph has been considered so much more important than it was at the time of the first edition, that it is given at great length, and, together with the cardiograph, it is now placed in the section on "Physical Examination of the Chest." Apropos of the heart, functional or hæmic murmurs receive somewhat short notice; we doubt whether they are always ventricular-systolic in rhythm, though, undoubtedly, they usually are so. The methods of examination of the blood are given at greater length than in the first edition, and form a useful addition.

The section on "Jaundice" without obstruction is entirely rewritten to keep pace with scientific progress. The chapter on the "Urinary Organs" is enlarged and the newer tests for albumen and sugar are included. This is one of the best, as it is also one of the most important, chapters in the book.

On the other hand, the chapter on the method of performing post-mortem examinations, which formed a fitting ending to the first edition,

has been omitted in the new revision. This is to be regretted. It seems a pity that a somewhat philosophical chapter like that on the physiognomy of disease should be written in a style that is sometimes obscure, from the length of the sentences and the number of parenthetical phrases. Here and there in the book we come across a Scotticism which has slipped in unnoticed. The word *incipient*, which occurs somewhat frequently, might be allowed to drop out of medical terminology with advantage. Its proper meaning of "*commencing*" is unobjectionable; but it is unfortunately used also in the sense of "*being present, but without showing any signs of its presence*," and thus is a convenient cover for a guess, which is hazarded without sufficient foundation in fact. "Incipient consumption" is a not uncommon "diagnosis" where a delicate patient, with no organic disease, is the subject of solicitude. It is noticeable also that typhus is frequently used in this book as a type of an acute febrile illness. Typhus is now by no means a common disease, and so is a bad one to choose as an example. There is sometimes a suspicion that "typhoid" may have been intended, but it certainly is not so in many of the instances where "typhus" occurs.

A very marked improvement in this over the previous edition is the giving a good bibliography at the end of each chapter, instead of mentioning a few works in a foot-note at the commencement of each subject.

A very careful revision has, in fact, increased the value of a very useful work.

LECTURES ON DISEASES OF THE NOSE AND THROAT. By CHARLES E. SAJOUS, M.D., of Philadelphia. Illustrated with 100 chromo-lithographs from oil paintings by the author, and 93 engravings on wood. 8vo. pp. 439. Philadelphia: F. A. Davis, Att'y. London: Cassel & Co., 1885.

THIS is a very fair exposition of the subject for the beginner and is much above the average of most elementary treatises on nasal and throat affections. The more modern appliances employed in the diagnosis and treatment of this class of diseases are figured and their uses explained in a clear and concise manner, while a number of new instruments, or modifications of old ones, are added from the armamentarium of the author. We are surprised that a Philadelphian should call the Fahnestock tonsillotome "Mathieu's," and should be apparently unfamiliar with the best of such instruments, the tonsil guillotine of Physick.

The methods of treatment are, as a rule, those usually resorted to by specialists in this country and may be safely followed by the student. The descriptions of diseased conditions are in many respects incomplete and superficial and important omissions occur which detract from the completeness and mar the symmetry of the volume. Thus, for example, although nearly one-half the work is (very properly) devoted to diseases of the nasal passages, no reference is made, except incidentally in the chapter on "hay fever," to the nasal reflex neuroses, a subject which, above all others, is the burning rhinological question of the hour.

On page 138 the incorrect statement is made that Voltolini, in 1872, first showed that asthma arose from "pressure upon or irritation of the posterior ends of the turbinated bones."

One of the principal features of this book, and that which will perhaps attract most attention, is the pictorial. The colored illustrations vary in excellence. It may be said, in general, that those which represent the macroscopical appearances will be found of great value to those who desire to familiarize themselves with the morbid conditions which they indicate, and that they possess the additional advantage of originality. Those, on the other hand, intended to set forth the microscopical appearances (as, for example, the erectile tissue and atrophic rhinitis) do not present either in color or design even a diagrammatic resemblance to the original. Indeed, it may be said that the color of all the plates needs toning down and that they would be more true to nature if executed in less pronounced shades of red and blue.

We are sorry to find that certain incorrect statements and unsupported claims to originality made in the brochure of the author on "hay fever" are reproduced without alteration in the present volume. Dr. Sajous not only creates the impression, but makes the direct affirmation that the combination of the three prevalent theories regarding the disease was suggested by him in a paper read and published in 1883, whereas the latter contains no evidence whatsoever of such intention. The assertion that the combination of factors—*i. e.*, the external irritant, the abnormal excitability of the nerve centres and sensitive area through which the system is influenced—was affirmed in his first article, not only, therefore, carries with it a wrong impression but seemingly invests the author with a sort of prescience which enabled him, in manifest and acknowledged ignorance of Beard's researches and long before certain more recent theories were propounded, to reconcile all with the pollen theory in the triumphant solution of the problem.

We can scarcely believe that Dr. Sajous is serious in his claim to priority in the matter of treatment by cauterization of the nasal mucous membrane, or, as he prefers to call it, "superficial organic alteration." As is well known to those acquainted with the literature of the question, this line of treatment had been distinctly laid down by others long before Dr. Sajous ever wrote upon the subject, and if the author's language be compared with that of those whose written and published contributions preceded his own clinical observations in the matter, it will readily be seen that the substitution of the ponderous phrase "superficial organic alteration" for the more commonplace term "cauterization" is but the trading of words in the interest of a distinction without a difference, and is eminently suggestive of the distance that separates Tweedledum from Tweedledee.

The observations of Dr. Sajous are interesting as giving support to one side of the present doctrine concerning "hay fever," but the historical facts in the case unfortunately exclude him from originality both in the matter of the pathology and the treatment of the disease.

We have refrained from going into an extended criticism of the author's claims and have made the above statements in the interest of historical accuracy and in simple justice to those from whose observations and experience the new conceptions of this affection have arisen. We have done so also in justice to the author, for in their uncorrected condition, his publications place him in the false light of a pioneer in matters in which he is simply and solely a follower.

On the whole, the book is written in an easy style, its general make-up is excellent, and we can cheerfully commend it to the student, who will find in it much practical information.

J. N. M.

THE SCIENCE AND PRACTICE OF SURGERY. By FREDERICK JAMES GANT, F.R.C.S. Third edition. 2 vols., 8vo. pp. 2185. London: Ballière, Tindall & Cox, 1886.

THE fact that a work of the magnitude of the treatise before us has reached its third edition, and that it has had an extensive circulation in America and the colonies, sufficiently attest the success which has attended it and the estimation in which it is held by the profession at large.

In the interval of time which has elapsed since the publication of the second edition of the work, in 1878, there has been, as Mr. Gant points out in his preface, "some positive advance in the frontier of the science, and not unfrequently corresponding achievements in the art of surgery, supplemented by the further teachings of experience." Naturally, therefore, in bringing the work up to the standard of to-day, it has been found necessary to introduce much new matter, so largely adding to the size of the book, whilst the original text has undergone extensive emendation, each chapter bearing ample evidence of careful revision. Nevertheless the general arrangement of the work, which is simple and comprehensive, remains unchanged. We need, therefore, but briefly notice some of the more important alterations and improvements which have found a place.

Amongst the subjects which have been dwelt upon more fully and treated at greater length, in this edition are those relating chiefly to inflammation, tumors, as including the sarcomata, wounds and the anti-septic treatment thereof, a section on microorganisms and their relations to the production of septic and other diseases—under the title of "Bacteria in Surgery"—having been contributed by Mr. Watson Cheyne. Neuropathology and the surgery of the brain, the operative treatment in reference to cerebral localization being fully discussed and explanatory diagrams appended; excisional surgery and osteotomy, abdominal surgery, and intestinal obstruction; much new matter in connection with the surgery of the kidneys and viscera having been incorporated; and diseases of the genito-urinary organs, the treatment of which constitutes a somewhat special feature of the work.

In more special departments Mr. Gant has invoked the aid and skill of Mr. Henry Power, Mr. Laidlaw Purves, and Mr. Charles L. Tonces, who, respectively, have written the chapters on "Diseases of the Eye, the Ear, and the Teeth." Dermatology has been ably and concisely dealt with by Mr. Malcolm Morris. Dr. Morell Mackenzie contributes the section on "Diseases of the Larynx," Dr. Robert Barnes that on "Diseases of the Female Genital Organs," whilst Mr. William Adams treats of "Deformities," as including orthopædic surgery and lateral curvature of the spine; and Mr. William Rose has revised the sections upon "Cleft Palate and its Treatment." The ability of these "literateurs" to discuss the subjects which have been allotted them is so generally recognized, that criticism of their work is unnecessary; curious errors have, however, sometimes crept into the text; for instance, we find in the section on "glaucoma," reference to the closing "of the lacunar system, known as the *canal* of Fontana," the canal of Schlemm being evidently meant. We regret, also, that more care has not been exercised

in the production of the illustrations of the fundus and its diseases, these being anything but satisfactory.

Of Mr. Gant's work, as a whole, we can but speak in terms of commendation. Throughout it bears the impress of the matured thought and deliberation, of the critical judgment in the treatment of disease, which one would expect to find reflected from a mind stored with the teaching of a long experience. Mr. Gant is always "readable," often highly original, but occasionally his descriptions of the pathology of disease, upon the importance of which he rightly lays so much stress, is hardly commensurate with the more recent advancements in that direction. Thus, in the chapter on tumors, the classification of the varieties of cancer is given as follows: "Cancer comprises three typical species; encephaloid, scirrhus, and, perhaps, colloid with many sub-varieties; distinguished chiefly by shades of difference in their general characters of color, consistence, shape, size, and mobility. Epithelial cancer, as another form of this growth, is taken separately. The insufficiency and looseness of such a classification are at once obvious, stereotyped, though it may be in older text-books. Under which heading are cancers of the thyroid gland, or of the kidney, or of the ovary, etc., to be placed? Again, no reference to tuberculosis as a cause of joint diseases is mentioned, such affections being included under the general designation of scrofulous inflammation or scrofulous diseases of the joints.

The author's reading has been wide and varied, and his criticisms of views, other than his own, on debateable questions, are generally excellent. It may here be mentioned that Mr. Gant cites as an example of pyæmia the case of William the Third, who fell off his horse and fractured his clavicle; at least, so he interpretes Lord Macaulay's graphic account of the death of that king, and, we think, with every probability of truth.

The work is contained in two large volumes, the type and printing being all that can be desired. The illustrations, which amount to one thousand and ninety, are, with certain exceptions, very good, while the index to each volume is full and complete.

In conclusion, we cannot but congratulate Mr. Gant upon the successful issue of the third edition of this work, which to him must have been a labor of love, and is alike creditable to the author and publisher.

RECENT WORKS ON NERVOUS DISEASES.

PARALYSES: CEREBRAL, BULBAR, AND SPINAL. By H. CHARLTON BASTIAN, M.A., M.D., F.R.S. London: H. K. Lewis. New York: D. Appleton & Co., 1886.

THE FUNCTIONS OF THE BRAIN. By DAVID FERRIER, M.D., LL.D., F.R.S. Second edition, rewritten and enlarged. London: Smith, Elder & Co., 1886.

A MANUAL OF DISEASES OF THE NERVOUS SYSTEM. By W. R. GOWERS, M.D., F.R.C.P. Volume I. DISEASES OF THE SPINAL CORD AND NERVES. London: J. & A. Churchill, 1886.

OF late years the subject of neurology has advanced in a most striking and marvellous manner. A generation ago the very axioms of nerve

pathology were barely outlined. Glimmerings of truth may be found here and there in the works of some of the great masters of our art, who have long since passed away. But with Duchenne a new era began. The pathology of the nervous system became fixed on a sure basis. The methods of research were strengthened and modified by science.

Since Duchenne's time the advance has gone on, slowly at first, but within the last decade at a speed almost bewildering in its impetuosity. Three works, epoch-making works, written by men whose names are almost as household words in medicine, form the subject of our review. It would be impossible to discuss these works in anything like detail. They embrace the entire field of nervous diseases both clinically and pathologically, and on this account their intrinsic value can only be appreciated by the reader himself. The development of our knowledge in this branch of medicine, to which we have alluded already, is at once evident on perusing any one of these three works. Gowers's book, which is a compendium of our existing knowledge of the diseases referable to the spinal cord and nerves, may, for the sake of convenience, be discussed first. But to call it a compendium or compilation is scarcely justice to the author, who himself has contributed so much to our standard knowledge of nervous diseases.

On the nature and significance of the tendon reactions most authorities are not yet agreed. The arguments against the reflex view are stated with great clearness and precision by Gowers. The shortness of the interval between the tap on the tendon and the muscular contraction seems almost conclusive against the theory that the phenomenon depends on a simple reflex action. Gowers believes that the contractions are local, but that a reflex influence is also concerned in their production. "If we regard the contractions as local we have still to account for the irritability which permits the local stimulus to cause a contraction. This irritability is developed by passive tension. . . . Hence I have suggested that the tension excites, by a reflex influence, a state of extreme irritability to local stimulation."

Great prominence is given by Gowers to the subject of peripheral neuritis, and probably no better account exists in any of our text-books on nervous diseases. There is little doubt that many of these conditions, which were quite lately ascribed to spinal affection, are really dependent on disease of the peripheral nerves.

In this connection it is interesting to compare the views of Bastian on so-called alcoholic paralysis. He says (pp. 596 and 597): "all these divergences of result and opinion decidedly strengthen me in my notion that the name 'alcoholic paralysis' is an unfortunate one; that at present there is no one condition which answers to this name; and that its adoption will tend to encourage the making of an easily arrived at, slipshod diagnosis, or what seems to be such, when in reality no diagnosis in the proper sense of the term has been made. There is great danger, in fact, that the term 'alcoholic paralysis' may soon come to be just as meaningless, and, it may be added, erroneous, as its compeer 'hysterical paralysis' is too often found to be." This warning is not inopportune, although possibly few will be inclined to coincide fully with the views of Dr. Bastian. The nervous symptoms of a paralytic nature induced by alcohol certainly differ widely in their nature and in their grouping; but that such and such symptoms are due to alcoholism may usually be asserted with confidence. This, in itself, is an advance

on our former notions, and has a modifying influence of the greatest importance on prognosis and treatment.

Our knowledge of the various physiological tracts in the spinal cord is far from complete. Thanks to the early efforts of Ludwig Türck, and, of late years, to the elaborate researches of Charcot, the course of the voluntary motor impulses in the brain and spinal cord has been defined with great accuracy. The functions of the posterior columns and the conditions under which they become degenerated are known with scarcely less precision. But there still remains a *terra incognita* in the spinal cord. Until quite lately, the functions of that large tract of white matter lying between the crossed and direct pyramidal tracts were a matter of speculation. Then Flechseg, by the developmental method, gave us the direct cerebellar tract.

Later, Woroscheloff's experiments appeared to indicate that sensory impressions are conducted through the anterior mixed region of the lateral columns. In 1877, Gowers figured a tract, presumably sensory, in the artero-lateral region, and, a little later Hadden described symmetrical tracts of degeneration in almost the same position. Observations of Westphal, Tooth, Strümpell, and others, have recently appeared in corroboration. It is interesting, too, that within the last few months Bechteren has confirmed the existence of this tract by his researches into the development of the spinal cord. It is fair to add that so long ago as 1867 Bastian figured and described areas of degeneration, "adjacent to, and more or less continuous with, the direct cerebellar tract." On this point he says (p. 516):

"My own observation leads me to believe that considerable variation often exists in regard to the exact disposition of this lateral sensory tract and of the direct cerebellar tract, as well as in reference to their exact relations to one another."

With the recent developments of our knowledge of the physiology and pathology of the spinal cord, new types of disease appear to be evolved. An instance in point is Charcot's amyotrophic lateral sclerosis, formerly confounded with progressive muscular atrophy or primary lateral sclerosis. It would seem, from the writings of this celebrated observer, that there is really a morbid state having the characters which he describes. Gowers, however, is not of this opinion. An observation on p. 373 is to us startling in its novelty, and certainly does not coincide with generally accepted notions. He says:

"I have not yet met with a single case of progressive muscular atrophy in which the pyramidal tracts were unaffected."

Again (p. 378) he observes:

"It is probable that the pyramidal tracts are degenerated, if not constantly, at any rate in such a very large proportion of the cases of progressive muscular atrophy that Charcot's distinction is in effect giving a new name to an old disease."

Bastian too, although describing amyotrophic lateral sclerosis in full, seems to suspect the position assigned to it by Charcot. He remarks that it "might perhaps be regarded as a mere variety of 'primary lateral sclerosis.'"

That the evidence adduced by Gowers in favor of a distinct morbid

condition which he terms "ataxia paraplegia," seems open to the same objections which he himself urges against amyotrophic lateral sclerosis.

The occurrence of degeneration in the lateral columns is not very uncommon in what might be termed typical *tabes dorsalis*. Dr. Gowers, however, states his views and "his facts" with great clearness, and it is quite possible that the affection he describes is a distinct type.

Dr. Bastian's work differs materially both in scope and in arrangement from that of Gowers. It practically embraces the entire domain of cerebral and spinal diseases. To some the omission of treatment may appear a drawback, and we must confess that in our opinion it is so. Apart from this, the work fully sustains the great reputation of the author. The chapters on the varieties of aphasia and on cerebral localization are perhaps the best in the book.

It would be difficult to speak too highly of Ferrier's work. Although a second edition, it has been much enlarged and almost entirely rewritten. Many of his well-known experiments have been repeated and extended. In some respects, too, his conclusions have been modified, mainly in accordance with the more recent researches of Horsley and Schäfer. It is still a question as to how far the doctrines of cerebral localization, as deduced from the conditions found in lower animals, can be extended to man. The results of experiments have, to some extent, been confirmed by observations on man, but corroboration is still necessary before *la belle doctrine* of cerebral localization can be applied to man in its entirety. This consummation is probably not very distant. The recent brilliant results in brain surgery recorded by Horsley seem to be the first fruits of Ferrier's lifelong labors.

A few final words on the relative merits of these three works.

Gowers's volume is probably the most concise text-book extant. The illustrations are admirably executed by the phototype process. The classification of the contents and the general arrangement of the text are especially noteworthy. We anticipate with pleasure the appearance of the second and final volume, which will deal with diseases of the brain and general diseases of the nervous system.

For diagnosis, Bastian's work will take the highest rank. It is remarkable for its philosophical tone and for the author's critical comments on numerous obscure problems on neurology.

We have already spoken in the highest praise of Ferrier's book, and we need only add that we welcome this volume as the most complete and original work of its kind in existence.

INDEX-CATALOGUE OF THE LIBRARY OF THE SURGEON-GENERAL'S OFFICE, UNITED STATES ARMY. AUTHORS AND SUBJECTS. Vol. vii. INSIGNARÈS—LEGHORN. 4to. pp. [100] 959. Government Printing Office, Washington.

THE steady issue of the successive volumes of this great work, continues to be a matter of congratulation to every medical scholar, and to every American physician possessed of a proper share of national pride. Yet this steady issue is slow, and we find ourselves longing for the power to expedite the enterprise.

The progress of the work has made necessary a condensed list of the abbreviations used in the first seven volumes, and this list alone occupies one hundred pages. This list gives some idea of the enormous scope of the work, and of the very extended research which has been carried on in connection with its preparation. But it may help those of our readers unfamiliar with the work, to arrive at a more definite idea of its size when they are told that the volumes thus far issued refer to 73,574 authors, to 39,252 volumes, and 59,997 pamphlets, and that its subject-titles include the names of 70,513 books and 254,057 journal articles. Certainly no other book in this country presents such stupendous figures or gives evidence of such exhaustive, systematic, and careful labor. Volume vii. contains about the same amount of titles as each of its predecessors. We notice that no less than sixty-one pages are devoted to an enumeration of titles under the heading "intestines."

To analyze such a book is of course impossible, and there is nothing for it but to reiterate the same expressions of admiration by which we have, on other occasions, shown our appreciation of the energy, perseverance, and literary skill which led to the conception of the work, and have characterized its prosecution. Dr. Billings may very properly be again congratulated upon the progress made. S. A.

A REFERENCE HANDBOOK OF THE MEDICAL SCIENCES, EMBRACING THE ENTIRE RANGE OF SCIENTIFIC AND PRACTICAL MEDICINE AND ALLIED SCIENCES. By various writers. Edited by ALBERT H. BUCK, M.D. Vol. i. 1885, pp. vi. 808; vol. ii. 1886, pp. 814. New York: Wm. Wood & Co.

IN his preface to the admirable dictionary for which he is responsible, the Editor states the reasons which have governed him in the selection of topics, and the space allotted to the discussion of each. He has preferred, and we think wisely, to run the risk of allowing the reader to search in vain now and then for information in regard to some topic in which he is interested, rather than to extend the list of topics, under the necessity of producing articles so brief and so lacking in detail, as to give rise to disappointment.

The selection of topics has apparently, on cursory inspection, been made with deliberation and judiciously, and their relative space fairly proportioned; as indeed Dr. Buck's experience in this department of literature would naturally lead us to expect. The arrangement is purely alphabetical. The first volume extends from "Aachen" to "Cataract" (inclusive), the second volume opens with "Catarrh, Nasal," and concludes with "Eye." The list of authors is very long, and includes many distinguished names. The work of the authors appears to be well done. The type though small, is clear, and the proof-reading has been excellent. The illustrations are fair, and some are even above the average. This is a matter of congratulation in the present stage of commercial book-making, for illustrations which are positively misleading are far too common. Better no pictures than poor ones.

Detailed criticism of the text of the work is, of course, out of the question, but some random illustrations of its scope and character may be given. Thus the article on "Alimentation, Rectal," includes the

topic of "Rectal Medication," and occupies two and three-fourths columns, of about 700 words to the column. "Alicante" and "Alhama d'Aragon" take a column between them, the latter's share being just seven lines. The "Alps" are disposed of in fifteen lines; "Alteratives" are discussed to the extent of a column; the subject of "Ambulances" has nearly twelve columns; that of "Amputation" has sixty-two columns—*i. e.*, thirty-one pages. Some of the wood-cuts supposed to elucidate the latter article are bad enough.

The work will be completed in eight volumes, and a full index with cross references will accompany the last volume. It will be a highly useful addition to the "busy practitioner's" library, and the student will find in it much of value conveniently arranged, and tersely stated.

S. S. C.

A MANUAL OF SURGERY. IN TREATISES BY VARIOUS AUTHORS. In three volumes. Edited by FREDERICK TREVES, F.R.C.S., Surgeon to and Lecturer on Anatomy at the London Hospital. Vol. I., General Surgical Affections, The Bloodvessels, The Nerves, The Skin. Vol. II., The Thorax, The Organs of Digestion, The Genito-urinary Organs. Vol. III., The Organs of Locomotion and of Special Sense, The Respiratory Passages, The Head, The Spine. Duodecimos, 1866 pages, 213 engravings. Philadelphia: Lea Brothers & Co., 1886.

THESE volumes consist of brief practical essays up to the times, and presenting the more modern and advanced views. They are, in large measure, written by the younger English surgeons, by men who are now rising into prominence, and whose names are daily becoming more familiar to students; but some of the papers are from older hands, such as Mr. Jonathan Hutchinson and Sir William MacCormac. While the papers are by no means superficial, neither are they exhaustive, but go over the ground allotted to them with sufficient fulness to meet the requirements of every-day surgical practice. In doing this they accomplish the end in view, which, as the accomplished Editor informs us, is to present "a concise account of the leading facts and principles of modern surgery." Operative surgery and pathology are not prominently dealt with as a general thing, the aim of the book being rather to present the clinical, diagnostic, and therapeutic aspects of surgery. Yet the general principles involved in operations are considered, and some special procedures, such as tracheotomy, gastrostomy, and nephrotomy, are dwelt upon with minuteness of detail.

Taken as a whole, this book is fairly representative of English surgery, and well suited to the wants of students who desire to obtain a general view of the subject-matter, but it can by no means take the place of more extended treatises. We are fond of small books and fully recognize the advantages possessed by such, but we confess to some surprise that either editor or publisher should have consented to divide a manual into three volumes, when the matter could have been readily included in one of not unmanageable size. Each volume is, of course, handy and most convenient for the pocket, but the three together are by no means as easily managed as one larger volume. More especially is this the case with a work which covers so wide a field, and which is, therefore, deservedly entitled to be used as a work for ready reference. S. A.

ÉTUDES CLINIQUES SUR LES MALADIES DES FEMMES. Par le DR. HENRI SCHAFIER, Ancien Interne de l'Hôpital Rothschild. 8vo. pp. 276. Paris: G. Steinheil, 1886.

CLINICAL STUDIES OF DISEASES OF WOMEN. By HENRI SCHAFIER, M.D.

THE object of this work, says the author in his preface, is to prove by the clinical records of numbers of cases, that the vast majority of ill-defined nervous and dyspeptic symptoms which women so often manifest, depend upon some pathological condition of the genital apparatus.

As an introduction to these clinical studies, the first chapter is devoted to "The Physiological Menstruation; that phenomenon being explained by a new theory." To this chapter one turns with some curiosity, hoping to have new light thrown upon a much vexed question, only, however, to be disappointed. The "new theory" is as follows: "Every month, two or three days before the appearance of the menses, the genital apparatus becomes the seat of a considerable hyperæmia; the ovaries, broad ligaments, round ligaments, the tubes, and the uterus are much congested. This hyperæmia, which goes on increasing, creates a state of irritation which, limited at first to the organs of the pelvic region, soon extends itself to the entire organism. The nerve filaments of the great sympathetic, implicated in this general orgasm, act upon the terminal ends of the bloodvessel walls, dilating them and finally bringing about the escape of blood." This is not very clear, and the author fails to make it more so by his further explanation that "The action of the sympathetics is to open the terminal orifices of the uterine vessels," whatever that may mean.

In the description of the anatomy and physiology of the genital organs occurs this passage, "The uterus, the organ in which the ovule arrives, and in which occurs its fecundation, after it has met the male's fecundating germ," an assertion that will not find general acceptance.

The clinical studies, which follow, were evidently made by a physician and not by a surgeon; for instance, considerable space is allotted to the description of "ulceration of the cervix" and its accompanying reflex nervous symptoms, and one obstinate case associated with diabetes is recorded at great length, but nothing whatever is said of lacerated cervix or its treatment, in this connection.

In the chapter on dysmenorrhœa, another new theory is advanced, namely, that "Any perverted nervous action on the uterus can change its alkaline secretion to an acid one; this acid secretion clots the escaping blood, which becomes a foreign body in the uterus, and is the most common cause of dysmenorrhœa." To this acidity is also attributed the sterility often accompanying dysmenorrhœa, the acid killing the spermatozoa.

Great prominence is given to the "utero-ovarian" centre in the hypogastric plexus of the sympathetic, and the most diverse results are ascribed to its irritation: hypertrophy of the uterus, atrophy of the uterus, sympathetic paralyses, disturbances of menstruation, are all due, according to Dr. Schafier, to irritation of this centre.

The cases recorded throughout the book are such as are familiar to every practitioner, while the triumphant results of Dr. Schafier's treatment, after other physicians had failed, are recorded with disagreeable frequency. On the whole, the book will hardly repay serious study.

B. C. H.

QUARTERLY SUMMARY

OF THE

PROGRESS OF MEDICAL SCIENCE.

ANATOMY.

UNDER THE CHARGE OF

GEORGE D. THANE, M.R.C.S. ENG.,

PROFESSOR OF ANATOMY AT UNIVERSITY COLLEGE, LONDON.

THE NEURAL SPINES OF THE CERVICAL VERTEBRÆ AS A RACE-CHARACTER.

More than thirty years ago, it was pointed out by Owen that the neural spines of the cervical vertebræ in the skeletons of an Australian and a Bushman differ from those of the European in not being bifid. To ascertain the value of this character, DR. J. CUNNINGHAM has compared the cervical spines in fifteen Europeans and twenty-four individuals of lower races, including Australians, Negroes, Andamanese, Tasmanians, and Esquimaux, with the following results: 1. The spine of the seventh cervical vertebra is never bifid, and the sixth is rarely cleft even in the European. 2. The spine of the axis is regularly bifid in all the races examined (only one exception in a Negro). 3. The spines of the third, fourth, and fifth vertebræ are, with few exceptions, bifid in Europeans, but simple, as a rule, in the lower races. 4. The spines that are least frequently bifid in the lower races are the third and fourth, which are also the most stunted of the series. This arrangement allows a greater freedom of movement in the neck in the direction of extension.—*Journal of Anatomy*, July, 1886.

ON THE MORPHOLOGY OF THE CARPUS AND TARSUS.

H. LÉBOUCQ gives, *Anatomischer Anzeiger*, No. 1, June, 1886, his views of the morphology of the proximal constituents of the carpus and tarsus. He confirms Bardeleben's statement as to the existence in the human fœtus of a cartilaginous representative of the os trigonum, which is, however, not differentiated until later than the surrounding elements: but he agrees with Baur in regarding the astragalus as the intermedium, while the os trigonum with the posterior peroneotarsal ligament (posterior fasciculus of the external lateral ligament of the ankle-joint) are together homologous to the triangular fibrocartilage of the wrist-joint.

The cartilaginous calcaneum is divided into two parts, proximal and distal,

the former becoming the tuberosity; a considerable bloodvessel, which subsequently gives rise to Hyrtl's artery of the sinus tarsi, traverses the space between the astragalus and calcaneum; in the hand a similar perforating vessel runs between the lunar and pyramidal. It is thence concluded that the pisiform and proximal calcaneum, the pyramidal and distal calcaneum, the lunar and astragalus are respectively homologous. The carpal scaphoid is composed of radiale and centrale, and the tarsal navicular of centrale and tibiale (tuberosity), the second component being the less developed in each.

Like Baur, Bardeleben, and Albrecht, Leboucq is of opinion that the typical hand is not pentadactyle, and that the pollex or hallux in mammals represents the original second digit. He believes that in mammals a reduction has taken place on the preaxial, in batrachians on the post-axial side.

The ossification of the carpus and tarsus has been studied in a large number of subjects by CH. DEBIERRE in the *Journal de l'Anatomie et de la Physiologie*, May, 1886, and the following dates indicate the period at which he finds that the nucleus of each bone generally makes its appearance: Magnum, 11 to 12 months after birth; unciform, 12 to 14 months; pyramidal, 3 years; lunar, 5 to 6 years; trapezium, 6 years; scaphoid, 6 years; trapezoid, 6 to 7 years; pisiform, which is developed from two centres, 10 to 12 years. Calcaneum 5th, and astragalus 6th month of fetal life; cuboid, at time of birth; external cuneiform, 12 to 15 months after birth; internal cuneiform, 2 to 3 years, and middle cuneiform a very little later; navicular, 4th or 5th year; epiphysis of calcaneum, 10 to 12 years.

Debierre considers that the primitive pentadactyle appendage comprised two basal elements for each digit, so that the typical carpus or tarsus consists of a proximal and distal row of five bones each, a condition which is met with in the carpus of the mole. The five elements of the first row of the carpus become the scaphoid, lunar, pyramidal, and pisiform, the latter being originally double, as is shown by its mode of ossification; and those of the second row, the trapezium, trapezoid, centrale (which has become displaced and gained a position between the two rows), magnum and unciform. The proximal elements of the tarsus are navicular-scaphoid, astragalus-lunar, trigonum-pyramidal, and calcaneum-pisiform; those of the second row, internal cuneiform-trapezium, middle cuneiform-trapezoid, centrale-centrale, external cuneiform-magnum, and cuboid-unciform. The tarsal centrale has undergone a still greater displacement than its carpal equivalent, and is represented by the cartilage on the tibial side of the navicular in some rodents.

ON THE RELATIVE DEVELOPMENT OF THE MALLEOLI.

C. GEGENBAUR (*Morphologisches Jahrbuch*, August, 1886) directs attention to the difference in the relative size of the two malleoli in the foetus and adult. In the fifth month of foetal life the tibial malleolus is more prominent than the fibular. In the seventh month the two are of equal length; and from this time onward the fibular malleolus exceeds the tibial. The primitive condition agrees with that in apes, where the fibular malleolus never exceeds the tibial. The preponderance of the external malleolus in man gives greater firmness to the ankle-joint, and has been acquired with the assumption of the erect posture.

THE MECHANICS OF THE SKELETON OF THE FOOT.

G. HERMANN VON MEYER (*Statik und Mechanik des menschlichen Fusses*, Jena, 1886) devotes the second part of his studies on the human foot to an elaborate analysis of the construction of the foot skeleton in relation to its function as an organ of support and locomotion. Starting from the principle that the foot is not a single apparatus serving various purposes, but rather a complex of several apparatuses which result from different methods of grouping its individual elements, he proceeds to show what parts of the skeleton are directly involved in each of the chief modes of resting the foot on the ground, and how the apparatuses thus formed are adapted to receive and transmit the weight of the body. He then develops in a similar way the action of the foot in progression.

It is first shown by experiment that the supporting arch of the foot is formed essentially by the third metatarsal bone, the external cuneiform, the cuboid, and the os calcis. The arch is strengthened and completed by the astragalus and navicular, since a part of the counter-pressure acting on the anterior pillar is transmitted through the external cuneiform to the navicular, from which it is conveyed by the astragalus to the os calcis. The weight of the body is therefore supported, when it descends vertically through the leg to the foot resting on a level surface, by an arch of the bowstring type, composed of the astragalus, os calcis, cuboid, navicular, external cuneiform, and third metatarsal bones. The other metatarsal bones form lateral buttresses to the primary arch, and are called into play when the weight, instead of being transmitted vertically to the foot, presses more on the one side or the other, or when the supporting surface is inclined. In standing on the great toe, the ankle is extended to the utmost, the great toe is drawn outward and backward by the action of the peroneus longus, and the inner portion of the tarsus is strongly arched, the weight being transmitted through the astragalus, navicular, internal and middle cuneiform, and first metatarsal bones. In standing on the smaller toes, the outer edge of the foot is drawn inward and downward by the tibialis posticus, and the weight is borne mainly by the astragalus, navicular, external cuneiform, and third metatarsal bones; to a less extent also by the middle cuneiform and second metatarsal bones on the inner side, and by the os calcis, cuboid, and fourth metatarsal bones externally. In the last two attitudes the tarsal and metatarsal bones by which the weight is supported form a curved pillar comparable to the lumbar portion of the spinal column. It is demonstrated that the numerous ligaments of the foot are disposed so as to meet the strain falling upon the several bones in the above three positions.

In progression, the foot is first raised upon the smaller toes by the action of the calf muscles and the muscles passing round the malleoli: and then the weight is thrown inward on the great toe by the further contraction of the peroneus longus. The third and most important element in the propulsion of the body is a forcible push against the ground by the phalanges of the great toe under the influence of its flexor muscles, aided by the rapid extension of the ankle. In different modes of progression these three acts are variously combined and have different values. The pushing action of the great toe is especially hampered by the wearing of narrow and pointed boots.

ON THE MOVEMENTS OF THE DIAPHRAGM, AND THEIR INFLUENCE UPON THE ABDOMINAL VISCERA.

C. HASSE has studied experimentally on the cadaver the movements of the diaphragm and the influence which they exercise upon the adjacent abdominal viscera. His procedure consisted in measuring the extent of downward movement of certain definite spots on the under surface of the diaphragm during inflation of the lungs, and in imitating the natural action of the muscle by an apparatus of small cords and pulleys, exercising traction upon the central tendon in the direction of the fleshy fibres. The results obtained are summed up as follows:

The contraction of the fibres of the diaphragm causes a flattening of the right and left vaults of the muscle; and the central part of the tendon also descends, but to a less extent than the lateral portions.

As was first shown by Duchenne, the diaphragm elevates the sternum and lower ribs, and thus enlarges the base of the thorax.

The peripheral part of the diaphragm is separated from the thoracic wall during the action of the muscle, causing an expansion of the complementary sinuses of the pleura.

The positive intra-abdominal pressure is increased during the descent, and diminished, but not destroyed, during the ascent of the diaphragm.

The changes in form of the diaphragm are accompanied by corresponding changes in the shape of the liver, stomach, and spleen.

By the contraction of the diaphragm the resistance to the flow of the blood in the liver and spleen is diminished, and the circulation through those organs takes place more freely as the movements are more extensive.

The movements of the diaphragm have an important influence on the flow of the bile, and promote the passage of the contents of the stomach and intestine.—*Archiv für Anatomie*, August, 1886.

ON THE EXTENSOR PROPRIUS DIGITI MEDII AND PERONEUS DIGITI QUINTI MUSCLES.

WENZEL GRUBER continues his series of statistical researches on human myology, dealing in the seventh part of his *Beobachtungen aus der menschlichen und vergleichenden Anatomie* (Berlin, 1886) with the anomalous extensor proprius digiti medii and peroneus digiti quinti muscles. The extensor digiti medii was found, in 600 subjects, in 2.5 per cent. of the whole number of arms. It occurs in two forms, viz.: as a forearm muscle, arising from the ulna and interosseous membrane, in nearly 1.5 per cent., and as a short muscle confined to the hand, arising in the neighborhood of the wrist-joint, in 1 per cent. As a very rare variety both forms coexist in the same arm. The frequency was greater in the male than in the female, in the proportion of nearly 5 to 1.

The various forms and the frequency of occurrence of the peroneus digiti quinti were determined in 500 subjects. Of the 1000 limbs, the muscle was represented in 58.9 per cent., and absent in 41.1 per cent. It was very rarely met with as an independent muscle (0.3 per cent.), as a doubling of the peroneus brevis (0.2 per cent.), as a supernumerary head of the latter (0.1 per cent.),

or as an offset of the same muscle in the leg (0.4 per cent.). In most cases it appeared as the well-known slip from the tendon of the peroneus brevis in the foot (57.8 per cent.). In seven instances the tendinous slip on the back of the foot was provided with a small fleshy belly, and in one other the muscle was reduced to a special extensor proprius digiti quinti arising from the os calcis. The slip ended, for the most part, by joining the long extensor tendon of the little toe, but in some cases it was inserted into the capsule of the metatarso-phalangeal articulation, the fifth metatarsal bone, or the fascia covering the outermost dorsal interosseous muscle. In 80 extremities in which the peroneus digiti quinti existed, there was also a peroneo-calcaneus externus, from which Gruber concludes that the two are not different forms of the same muscle, as stated by Testut.

THE EPIBLASTIC ORIGIN OF THE GENITO-URINARY SYSTEM.

The idea that the epithelial elements of the genito-urinary system are derived from the epiblast was originally suggested by His, whose views received the support of Waldeyer. Hensen was, however, the first to show, in the rabbit, the manner in which this takes place, namely, by the separation of a portion of the epiblast immediately external to the protovertebral somites. In 1884 Spee gave a detailed account of the direct origin of the primitive urogenital mass from the epiblast in the guinea-pig; and now W. FLEMING publishes observations on the early embryo of the rabbit, which are in complete agreement with Spee's description of the development of this system. The epiblast over the intermediate cell-mass becomes thickened, and projects toward the mesoblast, forming the *uro-genital ridge*. The latter increases in size, becomes separated from the superficial or epidermic layer of the epiblast, and then fuses with the subjacent intermediate cell-mass. The development proceeds from before backward, so that in the same embryo the anterior sections show a more advanced stage than those nearer to the tail, and the changes take place very rapidly. That the uro-genital ridge is of epiblastic origin, and not composed of adherent mesoblastic cells, is shown first by the disposition of Hensen's membrana prima lining the deep surface of the epiblast, which can be followed on to the corresponding surface of the ridge, separating it from the mesoblast; and, secondly, by the condition of the cell-nuclei of the two layers during the growth of the ridge, those of the epiblast exhibiting signs of great activity, and being met with in all stages of karyokinesis, while the mesoblastic nuclei are generally quiescent.—*Archiv für Anat.*, Aug. 1886.

THE COLLATERAL CIRCULATION AFTER LIGATURE OF THE SUBCLAVIAN ARTERY.

HANS STAHEL describes the condition of the vessels in a case in which the subclavian trunk had been ligatured, and prefixes an account of some anastomoses not mentioned in the current text-books, which may be of service in setting up the collateral circulation after this operation.

The latter are—1, an anastomosis between a scalene branch of the subclavian and the posterior scapular artery; 2, a subacromial loop between the suprascapular and acromio-thoracic arteries; 3, anastomoses in the skin between branches of the transverse cervical, suprascapular, superficial cervical, acromio-thoracic, and posterior circumflex arteries; 4, an anastomosis between

the acromio-thoracic and coracoid branches of the axillary artery; and, 5, anastomoses between the anterior circumflex and superior profunda arteries. In the specimen dissected, the calibre of the subclavian artery was much reduced beyond the scalenus anticus muscle, whence it is inferred that the vessel had been tied antiseptically (probably with catgut), and that the ligature had been absorbed before the lumen of the vessel became obliterated by the adhesion of its walls. The collateral circulation was established mainly by the enlargement of the suprascapular and dorsal scapular arteries, the former being fully three times the normal size, also of the anastomoses of the scalene artery with the posterior scapular, and of the acromio-thoracic and long thoracic arteries with the internal mammary, as well as to a less extent through the anastomoses of the acromio-thoracic artery with the thoracic branch (Cruveilhier) of the posterior scapular and the superior intercostal arteries. In conclusion, the author discusses at length the mechanical conditions determining the varying degree of dilatation of the several branches of the subclavian.—*Archiv für Anatomie*, April, 1886.

PHYSIOLOGY.

UNDER THE CHARGE OF

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THE INFLUENCE OF LIGHT ON THE DEVELOPMENT OF BACILLUS ANTHRACIS.

M. S. ARLOING has performed some experiments on the influence of light on the bacillus anthracis, with the object of testing the work of Messrs. Down and Blunt and other observers. He presents the following conclusions, which are in the main confirmatory of those already arrived at:

1. Gaslight slightly injures the vegetation of bacillus anthracis.
2. Sunlight rapidly suppresses the vegetability of the spores, if the rays can easily penetrate the liquid medium holding them in suspension.
3. Sunlight gradually diminishes the vegetability of the mycelium and may modify the cultures as surely as heat.
4. These effects can only be obtained by composite white light, and not by any of its single constituent rays.
5. The effects occur in proportion to the intensity of the rays, and the transparency of the medium.
6. Light is a very important biological agent in the life of the "infinitely little."
7. Light is probably a factor in the mitigation of many, if not all, forms of virus.—*Archives de Physiologie*, April 1, 1886.

THE CHARACTER OF THE MUSCULAR CONTRACTIONS EVOLVED BY EXCITATION OF VARIOUS PARTS OF THE MOTOR TRACT.

PROFESSORS HORSLEY and SCHÄFER, by varying the frequency of the number of interruptions in the primary circuit of Du Bois-Reymond's inductorium by means of a reed-vibrator capable of adjustment, stimulated at various rates the following parts of the motor tract: (1) Cortex cerebri, (2)

corona radiata, (3) pyramidal tract, (4) motor nerves. The motions were recorded by means of a tambour in connection with the belly of the muscle, the changes in the thickness of which were drawn on a smoked surface. The general result of their experiments may be summarized as follows:

1. The rhythm of muscular response to electrical excitation of the nerve centres (but not of motor nerves) is the same, viz.: ten per second for all rates of excitation above ten per second. Below that rate of excitation the rhythm of response corresponds with the number of stimulations per second.

2. The rhythm of muscular response in the case of voluntary and reflex contractions is essentially the same as that which results from direct excitation of the nerve-centres, viz., ten per second.

3. The rhythm of muscular response in all cases of after-excitation (whether epileptoid or not) is fundamentally the same as that of voluntary and reflex contractions, but in the case of epilepsy the response "may present a secondary rhythmic summation which produces a clonus of slower rate." "Every prolonged contraction of the skeletal muscles which is provoked by excitation, whether natural or not, of any part of the nerve centres, is a tetanic contraction which has been produced by a series of impulses generated in the nerve-centres, and passing along the motor nerves at an average rate of about ten per second."

4. Excitation of the motor nerves is followed by muscular response the rhythm of which is in all cases equal to the rate of excitation.

They think it clear, therefore, that the rapidly succeeding impulses arising from the quicker rates of excitation are not transmitted unaltered through the motor nerve cells, but become summated within them, and converted into a smaller number of impulses, which are forwarded with a constant slower rhythm by the peripheral motor nerve fibres to the muscles.

VOLUNTARY CONTRACTION OF MUSCLE.

MESSRS. CANNY and TUNSTALL, under Prof. Schäfer's guidance, investigated the character of the continuous contraction of muscle in response to volitional impulses in man. They communicate the thickening of the muscles of the ball of the thumb by means of Marey's tambours to a smoked cylinder. Although there is a great deal of variation in the character of the tracings obtained from different individuals, and even tracings from the same individual at different times, and under different conditions, yet the rate of succession of the waves varies only within comparatively narrow limits. The extreme variations obtained in single seconds have been from eight to thirteen. The general conclusions arrived at are, (1) a prolonged voluntary contraction in man is an incomplete tetanus produced by from eight to thirteen successive nervous impulses per second. (2) The average rate of muscular response to volitional impulses is approximately the same in man as in other animals. (3) The average rate of muscular response to volitional impulses in man is approximately the same as the average rate of muscular response to rapidly recurring excitation of the nerve-centres in animals. (4) The average rate of muscular response to volitional stimuli in man is approximately the same as that obtained both in man and animals as the result of pathological or other excitation of the cortex cerebri producing epilepsy.

It would be a matter of no small importance to physiologists, if it could be thus easily settled by the graphic method, that the continuous contraction of

muscles produced by volition is excited by intermittent nerve-impulses in the same way as the artificial tetanus produced by interrupted electrical stimulation of a nerve; but in the face of the weighty evidence against this assumption, very clear graphic demonstration is needed to carry conviction. A number of tracings are delineated in illustration of these papers; however, they aid but little in arriving at positive conclusions, as their indefiniteness seems to indicate the possibility of extrinsic irregularities dwarfing the rhythm of the contractions, which seem deficient in the symmetry one would expect in such rhythmic phenomena. Some of the curves almost suggest a disturbance of the instrument from the tremor caused by the irregular contractions or relaxations of individual bundles of fibres by which this lateral method of examining a muscle is so easily influenced.—*Journal of Physiology*, April, 1886.

FORMATION OF GLYCOGEN.

DR. F. RÖHMANN, of Breslau, made a series of experiments on rabbits, to test the effect of certain substances on the amount of glycogen produced by the liver. Taking two similar rabbits, he fed them for a certain time on a standard diet, to which, in the base of one was added the substance to be investigated, while the other was used for comparison (control-animal). As the result of four experiments he concludes that more glycogen is produced when asparagin is added to the diet. Glycocoll was also found, though not so obviously, to cause an increase in the formation of glycogen. From three experiments, he concludes that rabbits supplied with ammonium carbonate, together with carbohydrate diet, produce more glycogen than those fed on the same carbohydrates without any such nitrogenous substance.

By comparative experiments, using ammonium and sodium lactate, he is convinced that lactic acid, even in the presence of ammonia, does not belong to those substances out of which the organism can form glycogen.

Other experiments show that sodium carbonate does not act like the ammonia salt in increasing the amount of glycogen. He further concludes that the ammonium carbonate increases the amount of glycogen, independent of its acting as an alkali, and he thinks the above facts may throw some light on the theory of hepatic metabolism.—*Arch. f. d. Gesam. Physiol.*, May, 1886.

MATERIA MEDICA, THERAPEUTICS, AND PHARMACOLOGY.

UNDER THE CHARGE OF

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ASIMININE—A NEW ALKALOID.

We are indebted to Prof. Lloyd, of Cincinnati, for advance sheets of that part of the next issue of *The Drugs of North America*, containing the note by Dr. Bartholow on the new alkaloid recently discovered and named by Prof.

Lloyd—*Asiminine*. This interesting principle is obtained from *Asimina triloba*—the so-called "Ohio papaw," but which, as Prof. Lloyd informs us, is a very different plant from the genuine papaw.

The preparation used in this course of experiments was a hydrochlorate of the alkaloid, the solution having the strength of $\frac{1}{60}$ th grain to the minim.

Asiminine was ascertained to have two distinct stages of action: a stage of excitement followed by calm, sopor, passing into stupor and insensibility. The condition of excitement is accompanied by a high degree of muscular activity. The muscular movements have a purposive direction like those of belladonna poisoning. A frog, for example, in this stage of the action of asiminine, goes through movements of jumping and swimming, and as the effects deepen, the movements of swimming occur with a certain degree of regularity, but are not rhythmical precisely. A slight touch at any point, but especially about the head, suffices to cause these movements until the narcotism reaches the extremest degree, but at last the movement is limited to the hind extremities and consists merely in separation of the toes and expanding the web.

Action on the motor nerves and muscles. Asiminine was ascertained to leave the motor nerves and the muscles in the normal state. When the sciatic was isolated, and the alkaloid prevented entering the limb, it was found that there was no difference in the action to stimulation of the nerve and the muscles.

Action on the sensory nerves. The acuteness of the sense of touch was apparently heightened. The faintest touch of the finest point until near the close of the action, caused prompt response, especially when the skin of the head was touched. These responses consisted in closure of the eyelids, depression of the head, and then the general muscular movement as of swimming. A stage of the action was after several hours reached, when very strong irritation caused no response, if so carefully done as to avoid awaking the sense of touch. If a toe were seized very dexterously without disturbing its position, it could be very strongly pinched without causing the least movement. If the skin of back or thigh were seized very carefully with fine forceps and pinched, no response followed, but any roughness of contact caused an immediate movement. It is found that if a saturated solution be applied to the mucous membrane of the mouth it causes numbness, and distinctly lessens the sense of pain. It is doubtful, however, whether this action can be utilized, since the solubility of the alkaloid is not sufficient to effect the necessary thoroughness of contact with the sensory nerve endings.

Asiminine slows without weakening the heart's action. Faradic stimulation of the accelerator apparatus increases the number of the pulsations. The vagus is apparently unaffected, until near the end, but further experiments are needed to determine to what extent.

During the stage of excitement the respiratory movements are increased; but as the condition of stupor deepens, they are correspondingly slowed. The most important and characteristic action of asiminine is that on the cerebrum; the stage of excitement with delirium in which movements of an apparently purposive nature occur; the stage of sopor and gradually deepening coma, with ultimate muscular resolution. If the hypnotic and anodyne action prove to be true of the higher animals and man, asiminine will be a useful addition to our therapeutic resources.

THE TREATMENT OF PROGRESSIVE PERNICIOUS ANÆMIA.

M. HENROT, of Rheims, in a paper read at the Medical Congress of Nancy on the subject of progressive pernicious anæmia (*Revue de Thérapeutique*, Oct. 15, 1886), thus refers to the subject of treatment: Transfusion has proved unsuccessful. Very useful in the anæmia due to hemorrhage, it has not succeeded in this form of anæmia, and probably because the peculiar state of the blood is due to a microbe. Nevertheless, Quincke has had two successful cases. The most appropriate medication consists in the inhalation of oxygen, the subcutaneous injection of quinine in large doses, and in the use of arsenic. Balkins has effected sixteen cures by the arsenical treatment.

ON EULYPTOL AND ITS INTERNAL ADMINISTRATION.

Under the name *eulyptol* (not "eucalyptol") SCHMELTZ designates a remedy prepared from salicylic and carbolic acids, and essence of eucalyptus—six parts of the first named and one part each of the others. This preparation may perhaps be useful as a surgical antiseptic, but when administered internally in doses of from eight to ten grammes (3ij to 3iiss), it can only act as an antipyretic. With this view Schmeltz has prescribed it in rheumatism, in which malady the eulyptol, because of the salicylic acid constituent, lessens the pain and joint swelling. By its use typhoid evacuations are disinfected and modified in character. It has also proved useful in catarrhal affections of the respiratory organs. It is soluble in alcohol and ether, but less soluble in water. It does not cause so much stomach pain and flatulence as the salicylates.

THE CURABILITY OF ARTERIAL CARDIOPATHYS.

In an elaborate memoir on the above named subject (*Bull. Gén. de Thérap.* for October 15, 1886), DR. HUCHARD has passed in review the methods of treatment most effective. Digitalis is always the most important medicine in the asystolic condition, but in the presystolic period—the prealbuminuric stage of Mahomed, of interstitial nephritis—the best remedy is the iodide in from one to three grammes (fifteen to forty-five grains) daily, continued over one or two, even four years. Under the use of this the arterial disturbance lessens, even disappears, whether the lesion is sclerosis of the coronary artery, myocarditis, valvular disease, aortitis, etc. If any are incredulous, our author reminds them how a graver lesion—aortic aneurism—is certainly made to disappear under the iodide treatment, as Boulland first proved, and the fact afterward confirmed by Potain, Paul, and Bucquoy, of France, and Craig, Chuckerbutty, Balfour, and Bramwell, of England. It was M. Germain Sée who conceived the idea of employing the iodides continuously for the relief of increasing cardiac hypertrophy. "Iodide of potassium," says Dr. Sée, "is a most valuable cardiac medicine, and is effective, not only in the dyspnœa or asthma, but it powerfully modifies the muscular lesions, notably myocarditis, whilst at the same time it increases the contractile energy of the vessels, facilitates respiration, and maintains in a permanent way the tonic of the heart."

Dr. Huchard holds that the iodide acts on the vessels in a similar manner,

and to this power is to be ascribed its curative effects in sclerosis of the arteries, aortitis, angina pectoris, etc. But one of the conditions of the success of this medicine is prolonged administration. It is necessary to give the iodide of sodium during two or three years at the least, in the dose of one to three grammes (fifteen to forty-five grains) daily. This medication, notwithstanding there are idiosyncrasies to be provided for, is perfectly well borne, and if the iodide be suspended during six or eight days of every month, can be taken as stated above without the occurrence of serious iodism.

Dr. Huchard prefers the iodide of sodium over the corresponding potash salt, because it is less toxic, the salts of potash endangering the production of *potassemia* (*uræmia*), which, as Messrs. Feltz and Ritter have demonstrated, is due to the retention in the blood of the potash, rather than of the other constituents of the urine.

ON THE ACTION OF CAFFEINE AS A DIURETIC.

In an elaborate research into the mode of action of caffeine, SCHRÖDER (*Archiv für experimentelle Pathologie und Pharmacologie*, October, 1886, Band 22, S. 39) states the following conclusions:

Caffeine must be regarded as causing diuresis by a direct stimulation of the renal epithelium. Hitherto no remedy has been known that affects in so high a degree the urinary secretion. In caffeine we have a remedy whose action on the kidney may be compared to that of pilocarpine on the salivary and cutaneous secretions, in so far that both cause a powerful secretion from the glands, but in the mode of the action there are important differences. Pilocarpine stimulates the excito-secretory nerves, while caffeine acts directly on the renal epithelium. It is not possible, as yet, to localize the part of the tubules on which it acts.

Very various have been the views entertained by clinicians as to caffeine's mode of action. Some regard it as acting in a manner similar to digitalis, holding that, like the latter, it slows the pulse and raises the blood-pressure. This parallelism cannot be admitted, and Maki has proved that their influence on the heart is different. Both raise the blood-pressure, but the mode in which this is effected differs. Digitalis acts on the heart muscle, increasing its power, whilst caffeine raises the blood-pressure by stimulating the vasomotor centre. It cannot be too strongly stated, that for the production of a diuretic effect, only those remedies are useful that raise the blood-pressure by increasing the power of the heart. If the blood-pressure is increased merely by stimulating the vasomotor centre, the renal secretion is checked in an exactly opposed sense. The diuretic action does not influence the manner in which the blood-pressure is raised. The pulse becoming fuller under caffeine, and also the slowing of the beat often observed, have led to the opinion that this agent acts like digitalis. Some physicians, however, like Gubler and Brakenbridge, have not referred the diuretic to the supposed cardiac action, but to a direct effect on the kidney. In one of the most recent discussions on this subject by Bronner (*Dissertation*, Strassburg, 1886) the doctrine of the parallelism of caffeine and digitalis is strongly opposed. That caffeine exerts a marked action on the heart's movements, even in cases of cardiac failure, cannot be affirmed. On the contrary, when the diuretic effect occurs, slowing of the pulse-rate is not observed. Nor did the diuresis take place in

the same way, as from digitalis. Thus, the pharmacological and clinical observations have alike demonstrated that the diuretic action of caffeine is entirely independent of any effect on the heart.

The stimulation of the vasomotor centre with the attendant excitement produced by caffeine, is the cause, not only of annoyance to the patient, but of interference with the diuretic action. The uncertainty of the diuretic action which is often complained of, is due to the varying excitation of the vasomotor centre in different persons. To eliminate this central excitation, one of two courses may be pursued: either to combine with caffeine an agent opposing its vasomotor action, or other members of the caffeine group that have the diuretic without the vasomotor effect, may be tried. Very good results have been obtained by the conjoint use of paraldehyde.

SULPHATE OF SPARTEINE.

DR. HANS VOIGHT publishes the results obtained from the use of the sulphate of sparteine, in Prof. Nothnagel's clinic (*Centralblatt für die gesammte Therapie*, October, 1886). These interesting observations were made in consequence of the very favorable results obtained from sparteine by Prof. Sée. It was first employed in 8 cases of valvular affections, and afterward in cases in which the heart's action was secondarily impaired (4 cases of emphysema, 2 of pleuritis, and 1 of catarrhal jaundice). The effect of sparteine, after several days' administration, was studied by means of Dudgeon's sphygmograph. The results were as follows:

In small doses sparteine increases the energy of the cardiac contractions, the pulse becomes stronger and higher, and the tension of the arterial system rises. The frequency of the respiration is at first somewhat increased, but after further use of the remedy is somewhat lessened. The diuretic action is quite decided, and in correspondence with the increased cardiac action. Not unfrequently a slight narcotic action is manifest in the form of quietude and disposition to sleep. Intoxication symptoms, such as dizziness, headache, palpitation, and nausea, seldom occur after the smaller efficient doses ($\frac{1}{15}$ – $\frac{1}{4}$ gr.), and when manifest are unimportant, quickly passing off; but if continued despite these symptoms they afterward cease.

Sparteine, as compared with the caffees, with *adonis vernalis* (*adonidine*) and with *convallaria*, is manifestly superior in respect to the precision of the doses, and relative safety of administration. It is indicated in the valvular affections, when compensation has not been effected and the pulse is small and weak; in valvular insufficiency without any special compensatory disturbance, as a regulating and tranquillizing remedy; in insufficiency of the heart muscle without valvular lesions; in pericarditis; as a diuretic, in which respect it is quite unsurpassed, and in conjunction with digitalis to promote the action of the latter drug.

We need hardly remind our readers that sparteine is one of the principal constituents of *scoparius* (broom).

OBSERVATIONS ON THE PREPARATIONS OF CANNABIS AND CANNABINUM TANNICUM.

DR. BUCHWALD, in the *Bresl. ärztl. Zeitschr.*, No. 24, passes in review some of the newer medicaments obtained from *Cannabis indica*, and attempts to fix

their precise value as compared with the established hypnotic and anodyne remedies.

The following are amongst the substances contained in the hemp plant to which its intoxicating qualities are in part attributed: *Cannabin* or *Haschischin* of T. and H. Smith; *Oxycannabin*, by Martius; *Cannabin* or *Hydracannabin*, by Personne, and *Cannabinine*, by Siebold and Bradbury. None of these have been subjected to clinical investigation. But a new era began with the cannabis preparations when Merck's *Cannabin tannate* was produced and made the subject of a physiological investigation by Fronmüller, who recommended it as a substitute for morphine under some circumstances. At first, using small doses, he found that larger ones were necessary, and at length settled on 3 to 4 grains as the hypnotic quantity of the *Cannabinum tannicum*. The pharmacopœia commission had stated 1 gramme (15 grains) as the maximum single dose and 2 grammes per day. The doses used by Fronmüller, sufficed in most cases to cause quiet sleep without any unpleasant after-effects. It is the more valuable, also, in that it does not check the secretions nor constipate. Intoxicating effects were observed only after large doses— $7\frac{1}{2}$ grains—yet in some cases of great pain as much as 20 grains were given. Fronmüller's statements have not been generally accepted. Eickholt observed that sleep was produced by it only after the larger doses mentioned above were given. Pusinelli concluded after his research that it may be a useful remedy in purely nervous, habitual, and neurasthenic wakefulness, but that it is not a pain-relieving remedy, and must be given in doses of from 5 to 15 grains, not being a dangerous agent. Stupor is caused by it; also dizziness, hebetude of mind, and, in some instances, instead of a tranquillizing action, excitement, nervous unrest, and increased wakefulness follow.

As tannate of cannabin has become quite cheap, Buchwald has used it in numerous cases in public and private practice. His conclusion is that the objections made by the authorities above mentioned to it are in the main justified, and that it is decidedly inferior to morphine, chloral, and paraldehyde as a hypnotic. He finds the excitant action so constantly unpleasant that patients become averse to taking it.

ANTIFEBRIN: A NEW FEVER MEDICINE.

DRS. CALIN and HEPP publish the results of some observations made on antifebrin at the clinic of Professor Kussmaul, of Strasburg (*Centralblatt für die gesammte Therapie*, Oct. 1886). Antifebrin (or phenylacetamid) is a pure white, crystalline, odorless powder, slightly caustic to the tongue, almost insoluble in cold water, but easily soluble in warm water, and freely in alcohol, and fluids containing alcohol, as wine. It has neither acid nor basic properties, and withstands the action of most reagents. Notwithstanding its close relations to aniline chemically, antifebrin can be administered in relatively large doses without causing toxic effects. The temperature of healthy animals is not affected by it. The clinical researches were made on twenty-four fever patients. It was administered in single doses, ranging from four to fifteen grains, in wafers, or simply stirred up in water, or dissolved in wine. Until now, thirty grains in twenty-four hours have not been exceeded; but the size of individual doses must be determined by the character, the severity,

and the stage of the fever, and also the idiosyncrasies of the patient. Notwithstanding its insolubility, the effect of antifebrin is quite as rapidly produced, and is four times stronger than that of antipyrin. Up to this time it has not failed in its action. The impression made by it on pyrexia is better effected by larger doses at longer intervals than smaller doses at shorter intervals.

URETHAN BY SUBCUTANEOUS INJECTION.

DR. HANS ROTTENBILLER communicates to the *Centralblatt für Nervenkrank.*, etc., No. 10, 1886, his experiences with the use of urethan subcutaneously. His observations were made on 14 patients, there being 240 administrations. Of these 14, 6 were imbecile, 1 senile dementia, 1 idiot, 1 chronic insanity, 1 epileptic, and 4 dementia paralytica. He began with seven and a half grains, but this had an effect on one only, a paralytic with wakefulness. In the other cases, with doses from seven and a half to fifteen grains, he obtained sleep for four hours, only the first few days; afterward, only one to two hours' sleep. From one dose of thirty to sixty grains, six to eight hours of tranquil sleep were procured in 8 patients. With 4 others (1 paralytic and 3 imbeciles), the same amount caused only two to four hours' sleep. In a case with intense maniacal excitement and lively hallucinations, urethan failed, and paraldehyde was resorted to with success. After receiving the injection of urethan, the patients fell asleep in fifteen to thirty minutes; some woke up in two or three hours, but remained quiet, and, perhaps, fell asleep again in a half-hour. There were no unpleasant after-symptoms, except vomiting in one case.

Rottenbiller concludes that urethan, in the large doses of two to four grammes (thirty to sixty grains), causes six to eight hours of quiet sleep, but larger quantities are not well borne. The principal excellence of the remedy is that it produces no untoward results. On one hand is the consideration that several hours' sleep can be obtained from large doses, and sometimes no more than two to four hours'; on the other hand, the high price of the drug, and this it was that induced Rottenbiller to use it subcutaneously.

NAPHTHALIN IN AFFECTIONS OF THE URINARY ORGANS.

At the session in August, 1886, of the French Association, held at Nancy, M. DE PEZZER made a report on the use of naphthalin in affections of the urinary passages, with fetid urine. The daily quantity administered was one gramme and a half (about twenty-three grains). The fetidity disappears in from three to five days, and the urine changes from muddy, alkaline, and purulent into a limpid liquid, neutral or acid in reaction, and free or nearly so, from pus. And this result is accomplished without disorder of the digestive organs, without increased diuresis, and, perhaps, with a favorable action on the kidneys and bladder in pyelonephritis and cystitis. It has thus proved superior to all other antiseptics used in these affections, and its administration by the stomach is preferable to local application.

M. BOUCHARD thinks he has obtained permanent disinfection of the urine, by the administration of naphthalin in doses which cause ill effects if given

too long. He expresses the belief, also, that naphthalin is decomposed into naphthil-sulphite of sodium, which is a strong disinfectant.

TREATMENT OF THE PAINS OF LOCOMOTOR ATAXIA BY ETHER AND METHYL CHLORIDE SPRAY.

DR. RAISIN (*Thèse de Paris*, 1886; *Bull. Gén. de Thérap.*, Oct. 15, 1886) finds that the pains of locomotor ataxia are amenable to treatment by refrigeration. Spray of methyl chloride and of ether notably relieves when the pain comes on. It should rather be directed against the seat of pain, than along the spine, although the latter may be complementary.

Ether spray is less disagreeable, more convenient, and has fewer disadvantages than methyl chloride spray. It may be added that, for relief of local pain, ethyl bromide spray has proved to be highly efficient, and has, in some respects, advantages over the ether spray. Dr. Raisin makes no allusion to this use of ethyl bromide.

MEDICINE.

UNDER THE CHARGE OF

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RECENT STUDIES IN PNEUMONIA.

FÄRANKEL (*Zeitschrift für klin. Med.*, Bd. x. H. 5 u. 6, 401-462) gives an exhaustive account of his bacteriological investigations, dividing his subject as follows:

THE MICROBE OF SPUTUM-SEPTICÆMIA.

He not only tested the infectious nature of the sputum of patients suffering from pneumonia, as well as of those affected by other diseases, but also examined that from his own mouth. He found that some of these sputa were either totally harmless when inoculated, or produced forms of disease differing from the sputum-septicæmia described by Pasteur, Sternberg, and others. The author's own sputum, on the other hand, proved itself most active in producing septicæmia. His method of procedure consisted in thoroughly mixing not too small a quantity of sputum with five to ten cubic centimetres of a seven per cent. salt solution; one to two syringefuls were then injected into the animals. Rabbits appeared to be the most susceptible to the virus. In a few hours they exhibited a rise of temperature to 41° or 42° C.; indisposition to eat; somnolence; somewhat laborious respiration; usually some twitching, and in thirty-six to forty-eight hours they were dead. The spleen

was always found to be three to four times its normal size; there was sometimes peritonitis, but the lungs and pleura were almost always normal.

Even before death, and still more abundantly after it, the characteristic cocci were to be found in the blood. These are oval in shape, mostly diplococci, provided with a capsule, and cannot with certainty be distinguished from Friedländer's microbe. That they are, in reality, totally different he shows later in his paper.

The two halves of the diplococcus which are contiguous, are somewhat flattened and broader, while the distal extremities seem slightly pointed. They may be stained in the same way as the so-called coccus of Friedländer.

The blood containing these microbes was highly infectious, and inoculations with it also produced septicæmia. All animals, however, are not equally affected. The action upon guinea-pigs varies. Pigeons, chickens, and dogs do not take the disease; mice and rabbits die invariably.

The raising of pure cultures of these cocci is difficult. It can be accomplished very well on agar-agar, or stiffened blood serum, at a temperature of 35°–37° C., but at the ordinary temperature of the room it does not succeed. Within twenty-four hours there is developed upon the surface of the medium a bright, transparent, grayish-white coating, resembling somewhat a drop of dew. Inoculations from the cultures produce the same disease as does the septicæmic blood.

As regards the diminution of the virulence of the septicæmia-coccus by cultivation at a more elevated temperature, after the manner of Pasteur, Fränkel found that one or two cultures in a fluid medium at 42° C. was sufficient to destroy entirely the pathogenic power of the microbes for the rabbit, to whose organism it is usually so poisonous.

Although he was able, in the autumn and winter of 1883, to produce septicæmia repeatedly by injection of his own sputum, a year later he found such injections totally without effect. This led him to study closely the sputum of very many patients with different diseases. As a result he found that there is none so adapted to produce septicæmia as that of pneumonic patients, not only at the beginning of the disease, but long after the crisis had passed.

THE MICROCOCCUS OF PNEUMONIA.

Fränkel has examined, during the last three years, the lungs of a large number of cases which had died of pneumonia, and has always found diplococci apparently identical with the well-known lancet-shaped forms already described by Talamon and Salvioli. He has never met with them in any inflammatory process of the lungs except genuine croupous pneumonia. He has succeeded in obtaining cultures in but a few cases, but these were identical in all but two instances. They presented an almost transparent, grayish-white coating upon the culture medium; would not develop at the temperature of the room; and resembled, indeed, in every particular, the culture of the sputum-septicæmia coccus. Inoculations, too, behaved in a manner precisely similar to those of this coccus; viz., rabbits and mice died from septicæmia; dogs, chickens, and pigeons shared an immunity; guinea-pigs were sometimes affected. In the cultures from two cases, as remarked, he had a different result. Neither had any effect upon rabbits, and one of them exhibited a few

short rod-like bodies under the microscope, although the vast majority of the microbes possessed the diplococcus shape.

THE RELATION OF THE PNEUMONIA COCCUS TO THE MICROBE OF SPUTUM-SEPTICÆMIA.

As already stated, the micrococcus of sputum-septicæmia occurs most frequently in the sputum of pneumonic patients. This can be seen in the following enumeration: 20 rabbits received injections of pneumonic sputum, and of these 10—*i. e.*, one-half—died of septicæmia; 18 received injections of sputum either from healthy persons (5), or from patients not suffering from pneumonia (13), and 3—*i. e.*, one-sixth—died of septicæmia. It seems, therefore, right to assume that the coccus of sputum-septicæmia occurs at least three times as often in the sputum of pneumonic patients as in that of other individuals.

From this fact, then; from the result of microscopic study of the expectoration and of the lung; from the nature of the cultures and their pathogenic properties as regards various species of animals, Fränkel believes that he is justified in regarding the coccus of sputum-septicæmia as identical with the species which he finds in the lungs in pneumonia, and in the pus of cases of empyema secondary to it. And he is also of the opinion, since he has never found the coccus in the lungs of any but pneumonic cases, that this microbe is the cause of pneumonia. The fact that it often occurs in the sputum even of healthy individuals renders it probable, on the other hand, that a certain predisposition to the disease, or some other factor must exist, such, for example, as "catching cold."

Concerning the difference between the lancet-shaped diplococcus and that of Friedländer, the peculiarities of the former have been sufficiently described. The cultures of Friedländer's microbe exhibit a very energetic growth at the ordinary temperature of the room, and an indefinite number of generations may be propagated from it. It is *not* poisonous to rabbits. It will kill mice when carried into the lungs with the air. Under the microscope, too, the cultures are different. In those of Fränkel's coccus there are to be found oval diplococci exclusively; while in those of the microbe of Friedländer numerous short bacilli are also to be seen. These, indeed, attain so considerable a length, that Fränkel thinks the organism should no longer be named "coccus," but "pneumo-bacillus;" and the small coccus-shaped forms observed are in this case to be considered as the smallest of bacilli. He applies the term "pneumococcus" exclusively to the diplococcus which he describes in his paper.

In one respect the two microorganisms are alike; namely, that they do not produce lobar fibrinous pneumonia, even when the virus is injected into the lungs. This is probably because the animals die too soon for it to develop.

In a second paper, published in the *Zeitschrift für klinische Medicin*, B. xi. H. 5 u. 6, Fränkel enters more fully into the characteristics of the pneumococcus, its causative relation to pneumonia, and its connection with cerebro-spinal meningitis.

He mentions two cases of this latter affection attending pneumonia, in which the pneumococcus was the only microorganism found in the exudate from

the pia. Cultures were made of it, inoculation performed, and septicæmia produced. He does not mean to say, however, that secondary meningitis is always caused by the oval diplococcus. The kind of organism observed will often depend on the nature of the primary disease. Foà and Uffreduzzi also have found Fränkel's microbe in the brain in two cases of meningitis with pneumonia. Senger reports five cases of meningitis secondary to the pulmonary affection, and in all the encapsuled diplococcus was similar to the pneumococcus. Other kinds of cocci were, however, sometimes associated with them, and Fränkel insists that to determine which of the species present in the meningitic exudate is the cause of pneumonia, we must study only those cases in which but one variety can be discovered.

One of the most striking peculiarities of the pneumococcus is that it loses its virulence with comparatively great ease and rapidity. Hence, to cultivate it successfully, the method of preparation of the culture medium must be most exact. It seems to grow best upon the stiffened blood serum, and retains its virulence for months, even to the fifty-third generation. But on agar-agar the pathogenic character is much more rapidly destroyed, unless renewed by propagation through animals by inoculation. The determination of the exact time when the poisonous property is lost was especially interesting. It was found that this depended largely on the proper composition of the agar culture medium, and especially on its degree of alkalinity. With the greatest care Fränkel was able to keep up the virulence as long as twenty-four days without the interposition of an inoculation, but this was exceptional. Transplantation must be made every fourth or fifth day, or oftener.

The great disposition of the pneumococcus to lose its virulence in a short time is shared by the coccus of sputum-septicæmia, and is still another proof of their absolute identity.

Fränkel knows no other species of bacterium, cultures of which can be confounded with those of this microorganism. Their very slow growth, and their peculiar brightness and transparency are quite characteristic.

The report of the investigations of WEICHELBAUM, to which Fränkel refers, was published some months ago in the *Wiener medicinische Blätter*, No. 25, 775, 1886. For two and a half years Weichselbaum has been studying the subject, not only of croupous pneumonia, but of other forms of acute inflammation of the lungs as well; such, for example, as splenization, lobular pneumonia, and the secondary forms. He has examined 127 cases, and made culture experiments in 87 of them, and describes four varieties of pneumonia-bacteria:

1. The *Diplococcus pneumoniæ*, which seems to be the same as the pneumococcus of Fränkel.
2. The *Streptococcus pneumoniæ*, which appears similar to the *Streptococcus pyogenes* and *erysipelatis*, but which is probably a distinct species.
3. The *Staphylococcus aureus* and *albus*.
4. The *Bacillus pneumoniæ*, which he claims is identical with the pneumococcus of Friedländer. This microbe must be classified among the bacilli.

The first species was found ninety-one times, and most commonly in cases of genuine croupous pneumonia; the second was seen in several cases of primary pneumonia, as well as in those instances in which the disease was

secondary to some other affection of which this microorganism was the cause; the third was only to be discovered in cases where it already existed elsewhere in the body; and the fourth was present in but nine instances, and only cultivated six times. These few varieties, especially the diplococcus, occurred in numbers proportionate to the freshness of the pneumonic process. While it was present but sparingly and without the capsule in the gray hepatized parts, and even in the red, it was to be found in large numbers on the boundary of the infiltration and especially in the œdematous portions. In several cases the same bacteria which occurred in the lung, were discovered in the intermuscular and submucous tissue of adjoining regions, such as the thorax, neck, and air-cells communicating with the nose, and in two cases of meningitis were found in the pia and the ventricles. Inoculation experiments were practised in different ways upon various species of animals, and with the following results: The first and second varieties usually caused death in the case of rabbits and mice, with bilateral pleuro-pneumonia, and with or without enlargement of the spleen. The fourth species acted as does the microbe of Friedländer, except that it did not prove innocuous to rabbits. Weichselbaum concludes that these different forms of bacteria may all be the cause of pneumonia, and that the poison therefore is not a unity. The agent in the greatest number of cases is the *Diplococcus pneumoniae*. He also claims that our division of inflammations of the lungs into lobar and lobular, croupous and non-croupous, etc., may be correct anatomically, but is not so etiologically; and that many of the so-called secondary pneumonias also are in this light really equivalent to the genuine primary disease.

PIPPING (*Fortschritte der Medicin*, 1886, No. 10, 319) has also been studying the relation of the microbe of Friedländer to lobular pneumonia. He has examined 14 cases, and in 7 of them found diplococci which resemble Friedländer's coccus. In 3 out of these 7 the capsule became distinctly colored by the method of staining employed, and the pure cultures obtained possessed all the characteristics of the microbe in question, while the results of the inoculation-experiments upon animals also proved them identical. In the other 4 cases similar cocci were found, but without capsules which could be colored, and the culture experiments were negative. Pipping concludes that this microorganism is the cause of broncho-pneumonia, as well as of the simple croupous form.

In this connection several other publications are worthy of note. Among them, one of considerable interest is that of THORST (*Deutsche medicinische Wochenschrift*, 1886, No. 10, p. 161), on the occurrence of the pneumococci of Friedländer in the nose. Thorst confirms the discovery by Klamann of cocci with capsules in the nasal secretion of *ozæna*, having found them in twelve out of seventeen cases, and having in some instances obtained pure cultures of them. Greater skill in stainings attending a more extended experience, revealed them also in cases of chronic rhinitis from other causes, and even in acute coryza. The cultures of the *ozæna*-coccus and of the pneumococcus of Friedländer were in all respects identical, and when injected into the lungs of mice caused death under the same dyspnoëic symptoms.

LANCEREAUX and BESANCON (*Archives Générales de Médecine*, Sept. 1886, 257-288) report a series of twenty-three cases of pneumonia occurring in the

Hôpital de la Pitié during 1886, which tend to confirm the view of this disease as a cyclic malady produced by a microorganism. It was observed most frequently in February and March, and in a considerable number of cases was preceded or accompanied by an attack of influenza. Its relation to this latter affection was by no means clear; for, although the course of the disease was in most instances very abnormal, it did not correspond exactly with the description given by writers of the "influenzal pneumonia" of 1837. Six cases originated within the hospital in the same one of three wards. All six occurred within a week of each other, in the month of March, and all died. A large number of pneumonic patients had been received from outside into this ward during the month of February. Had the disease been variola, no one would have hesitated to call this an example of contagion from without, and the authors firmly believe that this does constitute an instance of contagious pneumonia.

The ushering in of the disease by influenza was noticed in a similar grave epidemic in this hospital in 1861. The same is true of the great epidemic of 1837, and of many others.

The pneumonia of 1886 was distinguished from the normal form by other characters besides its marked contagiousness. Its invasion was often insidious, or preceded by influenza for several days. A frank chill was the exception. Pain in the side was very decided and persistent, and the dyspnoea often great. In most cases the expectoration was abundant, moderately viscid, not rusty, but rose-colored, as in acute congestion. The elevation of temperature was not in accord with the severity of the case, and was often very irregular, as was also the duration of the disease. Oval cocci were found in the sputum of all but two cases, and in the lungs of two of those patients who had died.

Lancereaux and Besançon also describe a case with the symptoms of pneumonia which developed at the same time and in the same room with several other cases, but which revealed at the autopsy a pleurisy with fibrino-purulent fluid containing capsule-cocci. The disease was probably produced by the same organic cause at work in the patients suffering from pneumonia.

One case reported revealed at the autopsy broncho-pneumonia, with vegetative endocarditis containing some pneumococci, instead of the staphylococcus.

In another instance there were found post-mortem ulcerative endocarditis and fibrino-purulent meningitis, in addition to pneumonia; and ovoid encapsuled cocci were discovered in the diseased portions of the heart, lungs, and brain. Another case was somewhat more complex. In a woman who had died of meningitis forty-seven days after the onset of pneumonia, they could find only streptococci in the brain. This, they think, is an example of the ingrafting of an infection of another nature upon that of pneumonia. The possibility of this occurrence is confirmed, they think, by the cases reported by Jaccoud.

The progress of this epidemic of pneumonia is interesting. Beginning in January, the number and severity of the cases increased until March, but with few deaths. Then came the height of the epidemic, and following this, grave fatal cases and severe complications until June, from which time it became less serious and frequent, and disappeared some weeks before autumn.

The occurrence of influenza dwelt upon by these authors is of great importance in connection with the publication of Thorst reported above.

JACCOUD's paper, just quoted, is briefly as follows (*La France Médicale*, 1886, i. 758): Following ordinary cases of pneumonia in previously healthy individuals, there is sometimes noticed a persistence of some of the local symptoms. Then, after an indefinite period, the situation of the patient becomes more serious, and he dies with undoubted symptoms of a systemic infection. At the autopsy we find foci of suppuration in that portion of the lung where resolution was not completed, and others in the viscera, or in various parts of the body. It seems certain that the suppuration in the lung was the point of departure for the general infection. The same microorganisms, too, are found in the lung, in the distant purulent foci, and in the blood. He reports two cases in which he has established this pathological evolution:

In the *first*, symptoms of infection began two days after the crisis, and somewhat later a collection of pus developed in the knee-joint. After death the right lung and the kidneys exhibited many small abscesses. In the right heart were filamentous vegetations, and in the left heart others of a sanious nature. In the pus from the lungs Jaccoud found the streptococcus and staphylococcus, besides the pneumococcus of Friedländer. The pyogenic microbes were discovered also in the purulent matter from the knee-joint; in the vegetations in the heart, and, in fact, in all the extra-pulmonary foci. Inoculation with the pus practised on animals caused their death, and the same microorganisms were found in the blood.

The *second case* was very similar. Resolution began, but was followed, a week later, by symptoms of general infection from a pneumonic focus which had not cleared up, and a larger deep abscess developed in the region of the left buttock. This was opened, the patient improved and left the hospital; but died suddenly some weeks later. Abscesses were found in the lung, heart, and kidneys, and streptococci and staphylococci were to be seen in the pus from these regions. No pneumococci could be discovered in the lung. Cultures and inoculations proved the cocci to be as stated.

Having a direct bearing upon the studies of Lancereaux and Besançon is a report by KEMPF (*Medical Herald*, Louisville, June 8, 1886, 71), which would seem to be an indubitable instance of the contagiousness of pneumonia. A serving man in a family had been sick with pneumonia for some time, and was in the third stage when first seen. Within four days four members of the family were attacked by the disease in a typical form. No other possible cause could be discovered, except that the house and premises were in a filthy condition.

Another contribution to the contagious nature of pneumonia is that of GRAHAM, read at the meeting of the Canada Medical Association, in Quebec, August, 1886. He related a number of cases which had come under his observation during the past year in which this disease appeared to be contagious. These cases were divided into four series—three in the first, two in the second, three in the third, and two in the fourth series. In some instances the evidences of contagion were very strong. The conclusions arrived at by the writer are as follows:

1. That lobar pneumonia is in almost, if not in all cases, an essential fever.
2. That it is a parasitic disease.

3. That it frequently occurs in the form of epidemics.
4. That it has occasionally appeared to be contagious.
5. That the disease, in an epidemic or contagious form, is nearly allied to erysipelas.
6. That the early and persistent administration of tincture of iron is the proper treatment for these cases.

All writers, however, are not agreed that pneumonia is an infectious disease.

ALEX. SHAW (*St. Louis Courier of Medicine*, 1886, 16, 22) reports several cases seeming to show the causal relation of vasomotor disturbances and pneumonia.

Cases 1 to 3. Three children, in different families, were attacked by severe gastric disturbance from eating walnuts. The symptoms were nausea, vomiting, colicky pain, and tenderness of the abdomen. On the second day, in each case, there were fever, pain in the left side of the chest, and cough; and on the third day, the physical signs of the first stage of pneumonia, with some consolidation, became apparent.

Fourth case. A stonecutter partook of a very hearty midday meal, and soon after, while at work, a stone fell upon his foot. He went home, and in the middle of the afternoon suffered from nausea, and vomited what he had eaten in much the same condition as when ingested. Upon the following day he entered the hospital, and rapidly developed symptoms of pneumonia.

Fifth case. A boy ate excessively one evening of cake. That night he became severely ill with acute gastric irritation, and before twenty-four hours had elapsed pneumonia showed itself.

Sixth case. The same child had subsequently another attack of pneumonia after acute indigestion following over-eating.

Seventh case. A child, recovering from catarrhal pneumonia, ate a quantity of sweetmeats. Soon after symptoms of acute indigestion appeared, and in less than twenty-four hours a relapse of the pneumonia followed.

Eighth case. Another child, recovering from catarrhal pneumonia, exhibited symptoms of indigestion, and in a few hours there developed a severe relapse of the pneumonia.

Now just as the flush appearing upon one of the cheeks in pneumonia teaches us that the vasomotor centre is involved in that disease, so the very common flushing of the face in indigestion shows the influence of the abdominal disturbance on the same centre. The spasmodic cough of indigestion, too, occurring particularly in children, is another evidence of a reflex perturbation of the vasomotor centre in this disease.

It is well known that the division or the paralysis of a sympathetic nerve increases the congestion of the part supplied by it, but diminishes its vital resistance; also that the action of the vasomotor centre may be exalted or depressed by influences derived from various sentient surfaces, the effect being felt either in the whole vascular system, or in a particular vascular area. Shaw, therefore, believes that pneumonia is in many instances produced by a disturbance of the vasomotor centre due to disordered digestion.

The exposure to extreme cold probably produces pneumonia in an analogous manner, viz., by occasioning through vasomotor perturbation a neuro-paralytic hyperæmia in a circumscribed area. The fact that, as a rule, but

one portion of the lung is involved (a whole lobe or lobes), would indicate that some nervous influence, rather than some microbe, is the cause of pneumonia. The redness and enlargement of the pneumogastic nerve, found by Eccheveria in cases of pneumonia, speak also against the view of the pathogenic nature of any microörganisms present.

The author thinks it much more likely that the area in the lung already inflamed simply affords a suitable nidus for the growth of the microbe.

SEIBERT (*Berliner klinische Wochenschrift*, 1886, No. 17, 269), associated with other physicians, has investigated the influence of atmospheric conditions upon the frequency of pneumonia. His conclusions, founded upon the study of 768 cases, are as follows:

1. The development of fibrinous pneumonia is favored by certain meteorological conditions to such an extent that the difference in the frequency of the disease in different months is explainable on this ground.

2. Low and decreasing temperature, great and increasing humidity, and strong winds, are individually capable of exercising this determining influence upon the disease.

3. If two of these factors exist together—*e. g.*, a high degree of humidity with a low temperature, or a falling temperature combined with a strong wind—more cases of pneumonia develop than if only one be present.

4. If all three of the conditions named above exert their influence at the same time, the number of cases of pneumonia is exceedingly large.

5. The frequent occurrence of cases of pneumonia continues as long as this state of the weather prevails.

6. The same meteorological influence is observed in the development of catarrh of the mucous membrane of the respiratory tract.

7. Catarrh already existing predisposes to pneumonia.

ON HÆMOGLOBINÆMIA AND ITS INFLUENCE UPON THE CONSTITUTION OF THE BLOOD.

In the physiological and pathological investigations concerning the constituents of the blood during the last ten years, hæmoglobin has received particular attention, especially in reference to its relation to, and union with, the stroma of the corpuscles. It has been discovered that quite a number of substances are able to separate the hæmoglobin from the latter, and allow it to mingle with the blood-plasma.

Beside these toxic hæmoglobinurias thus produced, there is a paroxysmal form caused by the action of cold, violent muscular exertion, burns, syphilis, and infectious diseases, and occurring after transfusion.

But a too exclusive attention has been paid to the appearance of hæmoglobin in the urine, and not sufficient to the process which produces it. There may, indeed, be fatal hæmoglobinæmia without hæmoglobinuria.

After this introduction, SILBERMANN, in the *Zeitschrift für klinische Medizin*, Bd. xi. H. 5 and 6, 459-487, makes a thorough study of the subject, particularly from this point of view, gives an historical sketch of the investigations which have been conducted by others, details his own experiments, and terminates his article with the following conclusions:

1. Hæmoglobinæmia and hæmoglobinuria represent a process in which the white blood-corpuscles, as well as the red, are concerned.

2. The hæmoglobin which has been dissolved in the blood, destroys the white blood-cells, and thus occasions a decided increase in the amount of fibrin-ferment.

3. This increase of the ferment can also be produced when the hæmoglobin passing into the blood plasma produces the substance necessary to the formation of fibrin-ferment by abstracting it from the protoplasm of the white blood-cells, without actually destroying them.

4. If there are large quantities of the ferment developed as a result of the action of hæmoglobin in the blood, fatal thrombosis may occur, or an excessive stasis in the large abdominal veins leading to a fatal anæmia of the brain.

5. If the action of the hæmoglobin is not so intense, not so much fibrin-ferment is developed, and consequently the abdominal venous stasis is not so great, although it is still considerable.

6. The excretion of hæmoglobin through the kidneys is accomplished chiefly in the tubuli contorti.

7. If, however, damage has been done to the glomerular epithelium through the general disturbance of the circulation, hæmoglobin will also be excreted in the Malpighian tufts.

8. The hæmoglobin rings found in the glomeruli partly are formed there, partly are produced by the backing up into them of hæmoglobin out of the tubuli contorti.

9. The convulsions appearing in toxic hæmoglobinæmia are to be considered as anæmic, not as uræmic.

10. The fever attending both toxic and paroxysmal hæmoglobinuria is occasioned by the large amount of fibrin-ferment circulating in the blood.

CONTRIBUTIONS TO THE PATHOLOGY AND TREATMENT OF BRIGHT'S DISEASE.

SEMMOLA, of Naples, recently made a communication, under this title, to the Académie de Médecine (*L'Union Médicale*, Sept. 9, 1886, 418).

According to his researches, true Bright's disease consists in a chronic diseased condition characterized by the following peculiarities:

1. Its etiology; namely, the excessively slow action of damp cold upon the skin, continuing throughout months or years.

2. A progressive weakening of the functions of the skin, reaching, finally, even their complete abolition. This is due to an increasing ischæmia and atrophy of the sudoriparous glands, a progressive atrophy of the Malpighian layer, and a proliferation of the connective tissue of the dermis.

3. A chemico-molecular alteration of the albuminoids derived from alimentation. This alteration is characterized by a diffusibility which is pathological, in consequence of which they fail to be assimilated, and are necessarily eliminated through all the emunctories, especially the kidneys.

4. A progressive diminution in the combustion of the albuminoids, expressed by the consequent diminution in the formation of urea. There results from this a lessening of the amount of urea excreted in twenty-four hours, without there being an accumulation of this principle anywhere in the body. The

blood of patients who have not reached the stage of uræmic intoxication contains a percentage of urea less than in the normal condition.

5. A serous infiltration of the subcutaneous tissue, making its first appearance in the face, of an erratic but progressive character, although its advancement is exceedingly slow, and not in proportion to the hyperæmia.

6. A very characteristic cachexia, out of proportion to the loss of albumen, but which represents a gross defect in the assimilation. This is demonstrated by the totally negative results attained by the employment of the most restorative nitrogenous dietary, even when the disease is in its first stage.

7. A secondary and very slow development of an inflammatory process of both kidneys at the same time. This possesses the characteristic histological feature of diffuse nephritis, typified by the *large white kidney*.

The author's *résumé* of the treatment to be employed during the long period in which the disease is still curable is as follows:

1. An exclusively milk diet. Ordinary nitrogenous food, and especially that very rich in nitrogen, ought to be proscribed, no matter in what period of the disease. Milk acts as a typical food, and not as a diuretic, and its beneficial action on nephritic patients is remarkable. This milk treatment should be pursued for a long time, and the attempt to test the tolerance for meat or for the yellow of egg must be made with the greatest reserve.

2. Methodical and repeated dry frictions of the skin, massage, and often the use of the vapor bath. Cold water treatment is to be avoided. It is never well borne by the patient, even at the beginning of the disease, on account of the lack of proper cutaneous reaction. Violent muscular exercise is also injurious.

3. The patient should live in a temperate climate, dry, and of even temperature. In winter, especially in variable climates, he should not go out much into the open air. Muscular exercise must be taken in his own room, which should be constantly at a temperature of 65° to 68° F.

4. Iodide and chloride of sodium should be given in progressive doses until the extreme of tolerance is reached.

5. If albumen has not entirely disappeared from the urine after the lapse of two or three months, and especially if the anasarca has completely vanished, it is best to substitute for the sodium iodide either the phosphate of soda, or the hypophosphite of soda or of lime in small repeated doses, giving 45-60 grains in the twenty-four hours.

6. Systematic employment of inhalations of oxygen.

7. The abandonment of the use of astringents as substances either useless or injurious.

ON SCLEROSIS AND ON INFLAMMATORY CONTRACTION OF THE VALVES OF THE HEART.

Although diseases of the heart have received so much attention, yet their chapter in pathology is not yet complete. HAMPELN (*Zeitschrift für klinische Medicin*, Bd. xi. H. 5 and 6, 487-510) claims that there is an especial need of a sharp distinction between two very important and distinct cardiac affections. The one a valvular contraction, arising usually from rheumatic endocarditis; the other a sclerosis of the valves, identical in nature with general arteriosclerosis.

At the present time the exact anatomical differences in the diseased valves are not understood, and this fact renders the subject difficult of study. Other anatomical items, however, aid in the diagnosis. Among them is especially noteworthy the frequent combination of sclerosis of the aorta, with the apparently similar affection of the valves developing at the same time. Again, the fact that all of the aortic valves are affected in this disease, while the mitral usually remains unaffected, is a marked feature.

The condition of the heart muscle shows certain peculiarities, depending on whether an endocarditis or a sclerosis has led to the alteration of the valves. In the first case we find a simple compensatory hypertrophy of that ventricle which is behind the affected valves—*e. g.*, in insufficiency of the aortic valves, the left ventricle; and in the same condition of the mitral valve, the right ventricle. The cause of this is mechanical; an increase of the work thrown upon the heart, which acts as a stimulant to its action.

In the second case there is often found besides the hypertrophy of the left ventricle, a similar condition upon the right side, which is not explainable from a mechanical standpoint. Sometimes a simple dilatation, or even an atrophy of the right ventricle is met with. The reason for the hypertrophy of both ventricles in sclerosis of the aortic valves is not known with certainty. It proves, at least, that something more than a simple mechanical stimulus is at work. Many other causes, not well understood, undoubtedly combine in sclerosis of the valves to produce this hypertrophy of the heart *in toto*.

Another ground for belief in the independence of valvular sclerosis is that it develops in advancing years, at a time when rheumatism rarely occurs; and that it affects almost invariably the aortic valves. Endocarditis, on the other hand, usually follows rheumatism, occurs at a much earlier period of life, and attacks chiefly the mitral valve. And acute recurring attacks of endocarditis appeared to the author to be situated only on the old rheumatic valvular lesion, but never on the sclerosed valves.

Etiologically, too, the two affections are distinct. Acute inflammatory rheumatism plays the chief rôle in the production of valvular endocarditis although its symptoms need not be at all pronounced, and may, indeed, be almost entirely absent. In a much smaller number of cases endocarditis follows other acute or subacute infectious diseases. Regarding the etiology of valvular sclerosis, there is nothing positive to be noted. No connection with any other infectious disease, especially with rheumatism, can be discovered. The abuse of spirituous drinks, or of tobacco, great bodily exertion, and troubles and worries of all kinds often precede it; and simultaneously with its appearance evidences of renal and hepatic cirrhosis, diabetes, and arthritis deformans are often noticed.

As regards the age of the patients observed by Hampeln, almost all those attacked by sclerosis of the valves were over fifty years old. He has, however, seen it in one case at the age of twenty.

The symptoms of the two diseases are also different. We need only consider those cases in which there is a lesion of the aortic valves, since the mitral valve so very rarely suffers from sclerosis. The following symptoms then are prominent, according to whether we have to do with an inflammatory contraction or with a sclerosis. In the first case there is almost always an insufficiency of the valves, with the usual auscultatory signs. In the second case

there is frequently a pure stenosis. The basal portion of the leaflets is rigid, while the margins, which are still soft, will prevent regurgitation. Upon auscultation of such a case, a loud systolic murmur is heard over the aortic cartilage and manubrium, and is sometimes loudest over the apex. It must not be forgotten that a systolic aortic murmur may be developed with normal valves, when there is a dilatation of the ascending portion of the arch of the aorta. Autopsies show, however, that sclerosis of the valves is by far the more common affection.

The different reaction of the two valvular diseases upon the heart has already been mentioned. The aorta and peripheral vessels are also differently affected. Following aortic insufficiency from rheumatic endocarditis there is a state of passive stretching, while in valvular sclerosis they exhibit atheromatous degeneration. Often, too, a true aneurism develops, while this is never the case after rheumatic valvular insufficiency.

The general symptoms differ markedly. The most prominent point is, that we have in lesions from endocarditis, evidences of a process which has run its course. The disease is ended, and only its results remain. The heart often adapts itself to the extra work thrown upon it, and there is nothing to show the casual observer that the patient has any trouble whatever. Even when the valvular lesion is a very serious one, there are still always present the signs of more or less *increased cardiac energy*, although this may not be sufficient to afford complete compensation. It is only at the very end that this cardiac strength is overcome. On the other hand, in aortic lesions resulting from sclerosis we find a disease still existing and continuously progressing, and in which there are always signs of *cardiac weakness*. Palpitation of the heart has existed from one to two years; then œdema of the lower extremities set in and rapidly extended. Some cases suffer from cardiac asthma, others from angina pectoris, others from Cheyne-Stokes respiration. Examination reveals general disturbance of the circulation and marked cachexia, which often resembles that of carcinoma. The heart is frequently enormously enlarged, systolic and diastolic murmurs are to be heard, and there is a sclerosis of the aorta and peripheral vessels. The disturbances of the circulation grow worse, and hydrops of the serous cavities appears. All treatment is without any but temporary benefit, and at last the patient succumbs to a death which is often most painful.

The writer does not mean to say that the symptoms, as described, are evident in every case. Often signs of serious sclerosis elsewhere—as in aneurism—come more prominently forward. Or there may be no threatening symptoms to be observed anywhere. Hampeln closes his article with a full report of 110 cases of valvular lesion, and arranges them according to the classification already described.

NEW TESTS FOR GLUCOSE.

VON JAKSCH recommends (*Zeitschr. f. klin. Med.*, vol. xi. p. 20) the use of phenylhydrazin (first proposed by Fischer) as a delicate test for glucose in urine, blood, and other fluids, by means of which quantities otherwise too small for detection may be shown to be present. His method of using it is as follows. To a test-tube about half full of water, twice the quantity of

phenylhydracin hydrochloride that will go on the point of a knife ("messer-spitzen") is to be added, and four times as much sodium acetate. The whole is then heated till the reagents dissolve, when an equal bulk of urine is added and the whole boiled *for twenty minutes* (this is important, as a short boiling leads to failure) in a water-bath, after which the tube is plunged into cold water to cool. In a former paper (*Mittheilungen des Wiener med. Doctoren-Coll.*, Bd. x.) Jaksch gives his method more exactly: 50 c.c. of urine are to be mixed with 2 grammes of phenylhydracin hydrochloride, and with $1\frac{1}{2}$ grammes of sodium acetate, dissolved in 20 c.c. of water; the whole heated in a warm bath from ten to fifteen minutes. If glucose be present, there occurs, amid a good deal of amorphous material, a yellow crystalline deposit, consisting of phenylglucoazon. The characteristic crystals are needle-like, and often united to form sheaves. Their melting point is at 204° C.

In examining various urines, von Jaksch never obtained a reaction in normal cases. In fever, and especially in a case of ulcerative endocarditis, traces of sugar could be demonstrated, so after chloroform narcosis, also in three instances of carbon monoxide poisoning and two of asphyxia from the inhalation of other toxic gases. On the other hand, the reducing properties of urine passed after caustic potash and sulphuric acid poisoning, and after the ingestion of benzoic and salicylic acids, were shown not to depend on sugar, since no crystalline deposit occurred.

In testing blood for glucose, it is first boiled with sodium sulphate, to remove the albumins, then filtered, and to the hot filtrate phenylhydracin and sodium acetate are added, when, on cooling, needles of phenylglucoazon will form. In this way he found glucose present in pus, and in abdominal and pleural exudations.

Two new tests for sugars are given in the *Monatshefte für Chemie* (*Phila. Med. Times*, Aug. 7, 1886), which, from their delicacy, promise at once advantages and disadvantages. They are as follows:

1. To 0.5 to 2 c. c. of the suspected fluid add two drops of a 15 to 20 per cent. alcoholic solution of alpha-naphthol. On shaking the mixture, a slight turbidity, from precipitation of the naphthol, will occur. Next add sulphuric acid to equal or double the original bulk, and shake again. A deep violet color will result if saccharose, lactose, glucose, levulose, maltose, or any carbohydrate or glucoside capable of yielding glucose with sulphuric acid is present. On the other hand, no reaction occurs with inosite, mannite, and quercite, nor with any of the substances contained in urine which may influence the copper tests, such as uric acid, creatinin, indican, pyrocatechin, allantoin, etc. Besides the various sugars just mentioned, such substances as vanillin, anethol, and methyl salicylate (oil of gaultheria), give the violet reaction. On diluting the above mixture with water, a violet-blue precipitate is thrown down, which dissolves in alcohol and in ether with a yellow, and in potassium hydrate with a golden-yellow, color. It is said this test is delicate up to 0.00001 per cent. of sugar, while the limit of Fehling's solution is 0.0008 per cent.

2. The same as above, except that a 15 per cent. to 20 per cent. solution of thymol is used, instead of naphthol. A deep red color results. On diluting the mixture a flocculent precipitate is formed which gives a pale yellow

solution when dissolved in alcohol, ether, or potassium hydrate; a bright yellow with ammonium hydrate.

Normal urines give the above reactions even when diluted from one to three hundred fold, which would seem to confirm the opinion of Brücke and others that traces of sugar occur in all urines.

To distinguish between a diabetic and normal urine, the following means are recommended:

1. Dilute both specimens one hundred fold and test each. The darker will be diabetic.

2. Diabetic urine gives a reaction even after the dilution reaches four to six hundred times the original bulk.

In trying these tests I have found the phenylhydracin to give very satisfactory results, while the thymol (the naphthol was not tried) was not at all so, inasmuch as a normal urine gave a far deeper red color than two specimens of diabetic urine, one containing over two, and the other over eight per cent. of glucose. It is possible that the thymol, which was a sample of the commercial kind used for disinfectant purposes, may not have been pure.

ON ACETONE IN NORMAL URINE.

This question, which has never been definitely settled to the satisfaction of all, has again been investigated with every precaution against possible error, by MOSCATELLI (*Archivio per le Scienze Mediche*, vol. x. p. 231). He used twenty-five litres of urine from healthy individuals. From each litre, separately distilled, he retained only the first few cubic centimetres that came over. These were all finally mixed and redistilled, the first four cubic centimetres going over being used for testing. In this no acetone was found, though tests were used sensitive up to one-half a milligramme of pure acetone. He hence concludes that acetone is not present in the urine of normal individuals (who have not taken alcohol).

FORMIC ACID IN DIABETIC URINE.

The red color which some diabetic urines give with Fe_2Cl_6 —commonly known as the “ferric chloride reaction”—is generally considered to be due to the presence of aceto-acetic acid.

LE NOBEL (*Centralblatt f. d. med. Wissenschaft*, 1886, p. 641) shows that it may also occur from the presence of formic acid. In seven specimens of diabetic urine he found formic acid present three times.

REACTIONS OF URINE AFTER THE USE OF NAPHTHALENE.

PENZOLDT (*Archiv f. exp. Path., etc.*, vol. xxi. p. 34) has discovered that if strong sulphuric acid be allowed to flow upon a small quantity of such urine a beautiful green color will result at the junction of the two fluids, which finally, as diffusion occurs, becomes a dirty gray or brownish-green.

SURGERY.

 IN EUROPE.

UNDER THE CHARGE OF

FREDERICK TREVES, F.R.C.S.,

 SURGEON TO, AND LECTURER ON ANATOMY AT, THE LONDON HOSPITAL.

RECENT SURGICAL LITERATURE.

The following new volumes of the *Dictionnaire Encyclopédique des Sciences Médicales* have been issued. The first runs from "Gro" to "Gua." The volume possesses no article of surgical interest, nearly the whole fasciculus being occupied by the monograph on pregnancy. In the volume that follows ("Gua" to "Gy") is a fair paper on gymnastics. The work is by M. Dally, and is somewhat ambitious. The history of gymnastics and the physiological effect of exercise are well described, but without the introduction of original matter. The paragraphs on "technique" deal with exercises without apparatus—posture exercises, walking, and running. The apparatus described is practically limited to the horizontal bar and the parallel bars. The part of the paper on curative gymnastics is very poor and far behind the times. It considers little but the methods of Zander. Of Ling and the excellent system of Swedish gymnastics we hear little. The author has missed the opportunity of bringing out an interesting and much needed work.

Nearly the whole of the volume "Haa" to "Han" is taken up with "Hanche," although it does not exhaust the subject. The anatomy of the hip-joint is founded solely upon the anatomy of the French school. Much space is wasted in still discussing the function of the round ligament. The chapters on the physiology of the hip are fair so far as they go. They conspicuously avoid mention of the work of English authors on the subject. The sections on congenital dislocations of the hip are very poor. Acquired dislocations are fully dealt with, and the matter is up to date. There is an excellent table of cases of late reduction of hip dislocations. The subject of hip disease (upon which so much good work has been done in France) is not commenced.

In the last of the new volumes, that running from "Ube" to "Uri," is a long paper on ulcers, by M. Rochard. The author lapses into the old and obsolete classification of ulcers. His arrangement is the following: Ulcers. 1. Simple; 2. Inflammatory; 3. Atonic; 4. Fungous; 5. Phagedænic; 6. Callous; 7. Varicose; 8. Syphilitic; 9. Malignant pustule; 10. Tubercular; 11. Cancerous; 12. Farcy; 13. Scorbutic; and, 14. Frostbite. The article is not up to the standard attained by the majority of the surgical papers in the encyclopædia. It adds nothing to our knowledge of the subject, and the pathology savors of the past.

The same volume contains an admirable article on uranoplasty, by Petit. The article "Urèthré" is among the best that have appeared. The anatomical sections are by M. Quènu. They contain much original matter, and the

author makes free use of comparative anatomy. The chapter on ruptures and wounds of the urethra by MM. Piqué and Quènu are perfect, and conclude with an excellent bibliography.

The chapter upon stricture, by MM. Desnos and Kermisson, is not equal throughout. On catheterism and catheters it is excellent, but it is evident that the authors believe only in French surgery. We find no mention of Otis, of Teevan, of Reginald Harrison. The only foreign urethrotome mentioned is Thompson's. The authors prefer internal urethrotomy to the use of Holt's dilator, and regard external urethrotomy as "une méthode d'exception." As an exposition of the views of French surgeons upon the treatment of stricture, the monograph is no doubt admirable.

The new volume of FOLLIN and DUPLAY'S *Traité de Pathologie Externe* completes the sections on the male genitals. It deals with preputial calculus, inflammation and tumors of the penis, varices of the penis, lymphatic varix and ossification of the penis. All these subjects are well dealt with and well illustrated. The chapters on elephantiasis and on cancer of the penis are poor. The diseases of the female genitals are commenced in this fasciculus. The authors still adhere to "esthiomene" in their description of chronic ulcers of the vulva. They state that it is a disease of adults, that it is allied to lupus, and owns the same etiology. The description of the sore is not very clear. There can be little doubt that this "esthiomene," to which French writers so tenaciously cling, concerns merely a tubercular ulceration of the vulva, that differs in no way from tubercular ulceration elsewhere.

The chapters on affections of the vagina are good. The volume concludes with a scanty section on displacements and deformations of the uterus.

DR. J. HOCHENEGG'S monograph (*Über symmetrische gangrän und lokale Asphyxie*, Vienna, 1886) furnishes a very complete account of our present knowledge of Raynaud's disease, with some new cases. It is the most exhaustive monograph that has yet appeared on the subject, although it adds little to what is known of the pathology of the affection. One very valuable feature is an exhaustive list of the already extensive literature.

Die Lehre von den Knochenbrüchen, by P. BRUNS, is among the most recent additions to Billroth's and Luecke's great work, *Deutsche Chirurgie*. It professes to be a complete treatise upon fractures in general, and is, without doubt, the most elaborate monograph on the subject that has appeared in any language. Every subject is fully dealt with—fat embolism, thrombosis in fractures, the manifold complications in broken bones, the processes of healing, and the various forms of non-union or mal-union. The work is worthy of its distinguished author.

Leçons de clinique Chirurgicale (vol. iv.), by M. PÉAN, is an immense volume of 1252 pages. It covers the years 1879 and 1880, and deals with a multitude of subjects. The first part is composed of fourteen valuable clinical lectures. The most noticeable of these are the following: Cold or Tubercular Abscess of the Tongue; Angioma of the Breast and Lymphangioma. These papers are admirably illustrated, and form important contributions to surgical

science. The second part consists of a vast collection of miscellaneous cases. Many of these—in fact, the majority—are of no special interest. Some are poorly reported, and the collection forms a cumbrous, undigested mass. The statistics of operations contain such trifles as opening small abscesses and removing fingers. It appears that between 1881 and 1884, M. Péan performed no less than 229 laparotomies for various affections. A greatly condensed and well-edited edition of the work would be acceptable.

The following recent papers may be noted:

“Lipoma of the Mesentery,” by M. Péan (*Gaz. des Hôpit.*, 1886, No. 39). Patient a woman of thirty. Enormous tumor. A pure lipoma. Laparotomy and removal. Cure.

“Removal of Osteo-sarcoma of Ribs,” by M. Humbert (*Revue de chir.*, 1886, No. 4). Woman of twenty-one. Parts of the eighth and ninth ribs removed. Pleura and peritoneum opened. Tumor adherent to diaphragm, which was wounded. Recovery. Subsequent death from recurrence.

“Perforating Ulcers of the Hand in a Case of Tabes Dorsalis,” by Dr. Terrillon (*Bull. de la Soc. de Chirur. de Paris*, t. xi. p. 408). Man aged twenty-six. Syphilitic: usual ataxic symptoms. The ulcers on the hand resembled the perforating ulcers of the feet.

“The Surgical Treatment of Empyema,” by Dr. Aufrecht (*Berliner klin. Wochenschrift*, 1886, No. 10), and by M. Potain (*Gaz. des Hôpit.*, 1886, No. 36).

“Primary Cancer of Cowper’s Gland,” by Pietrzikowski (*Prager Zeitschrift für Heilkunde, und Centralblatt für Chir.*, 1886, No. 35). Patient aged nineteen. Perineal tumor size of fist, of six weeks’ growth. Removal. Bladder and prostate clear.

“Arterio-venous Aneurisms of the Common Carotid Artery and Internal Jugular Vein,” by M. Pluyette (*Revue de chir.*, 1886, No. 4). A case is reported. The paper gives a full account of this rare condition based upon the analysis of sixteen reported cases.

“Tuberculosis of the Bladder,” by M. Boursier (Paris, 1886). An elaborate and valuable paper, founded upon the examination of thirty-seven cases.

“Case of Supposed Fracture of Neck of Scapula,” by Mr. Eales (*Lancet*, October 9, 1886).

“Case of Cervical Spina Bifida cured by Injection,” by J. Ward Cousins (*British Medical Journal*, 1886, p. 874). Child, ten weeks old. Morton’s solution used. Only one injection made. Cure in six weeks.

“Lumbar Spina Bifida cured by Extirpation of the Sac and Osteoplastic Closure of the Gap in the Spine,” by Dr. Dollinger (*Wiener med. Presse*, 1886, No. 7). Child, ten years old. Lower limbs deformed. Some nerves in sac.

“Spina Bifida cured by Operation,” by J. Barton (*Lancet*, 1886, vol. ii. p. 626). Child aged two weeks. Cyst in the lumbar spine excised.

“Perineal Hernia,” by Dr. H. Folmer (*Academisch Proefschrift*, Amsterdam, 1886). A very complete treatise on the anatomy, symptoms, and treatment of this rupture, with a collection of no less than forty-five cases.

“Bone-drainage in the Treatment of the Early Stages of Hip Disease,” by Sir William Stokes (Dublin, 1886).

“Case of Separation of the Upper Epiphysis of the Femur,” by A. W. M.

Robson (*Lancet*, 1886, vol. ii. p. 343). Child aged five. Injury when two years of age. Woodcut of the deformity produced.

"Retraction of the Penis," by Thomas Raven (*Lancet*, 1886, vol. ii. p. 250). Patient aged twenty-seven. Spontaneous retraction of penis. Penis had almost disappeared. Glans just perceptible under the pubic arch. Cure.

"The Distribution of Pyæmic Abscesses," by Stephen Paget (*Lancet*, 1886, vol. ii. p. 202). Analysis of two hundred cases of pyæmia.

MIDDLE MENINGEAL HEMORRHAGE.

MR. W. H. A JACOBSON (*Guy's Hospital Reports*, vol. xliii.) has produced under this title the most important contribution to surgical literature that has appeared for some time. The article is a credit to English surgery and must become classical. It is difficult in any abstract to give a proper conception of this remarkable paper. It commences with an account of the anatomy of the middle meningeal artery and of the parts about it. Then follow "the conditions which are liable to be met with in the parts concerned in middle meningeal hemorrhage." In the majority of cases the skull is fractured, but the existence of a fracture is not necessary for the production of the hemorrhage. The separation of the dura mater is to a great extent primary, and is due to the blow. The extravasation is secondary to that detachment. A fracture, if present, may be very minute or incomplete. Out of the 70 cases dealt with by the author, a fracture was present in 62, and in no fewer than 38 of these the base as well as the vault was involved. The trunk of the artery is comparatively seldom injured, and the usual advice as to the site of trephining is misleading. From two to three ounces represent the quantity of blood usually lost. The author divides all cases of middle meningeal hemorrhage into these three groups:

A. *The most hopeful cases for trephining.* Violence comparatively slight. Laceration of the artery or its branches. Fracture of skull, if present, slight and localized to side of skull—*i. e.*, not implicating base. Compression, but little or no contusion or laceration of brain. 27 cases (out of the 70).

B. *Less hopeful cases.* Violence greater. Laceration of the artery or its branches. Fracture implicating base. Some injury to brain, but this only trivial. 20 cases.

C. *Cases probably hopeless from the first.* Violence very great. Laceration of the artery or its branches. Fracture very extensive, perhaps implicating several bones and sutures both in vault and base. Injury to brain very severe. 23 cases.

The cases are reported in detail with comments and criticisms. The collection will prove a most valuable addition to clinical surgery.

The sections on the symptoms of middle meningeal hemorrhage are the most interesting. The author arranges them in the following order of value:

a. Interval of consciousness or lucidity. b. Condition of limbs as to hemiplegia, paraplegia, rigidity. c. State of pupils. d. State of pulse. e. Unconsciousness increasing and passing into coma. f. Character of the respiration. g. State of the scalp and cranial bones. It is impossible to give an abstract of the elaborate analysis of these symptoms. The following points, however, may be noted: In 63 cases the interval of lucidity is mentioned. In 32 it was

well marked. In 10 it was but little marked and might have been overlooked. In no less than 21 (one-third) it was absent.

The following abnormal conditions of the limbs may be met with. Hemiplegia may be well marked, or little marked, or be only temporary. It may be more marked in one limb than in the other. There may be paraplegia, or absence of any paralysis, or the limbs may be rigid and twitching.

The three most important conditions of the pupil are thus described :

1. If the pupils are natural as regards reacting to light, the compression of the brain is probably in a recoverable condition, if trephining is immediately performed. Furthermore, it is probably a case of compression only of the brain without laceration or other injury.

2. If the pupils are insensitive and often at the same time dilated, the compression is probably extreme, and while trephining is as urgently called for, it is less probable that in these cases the brain will recover itself after removal of the clot.

3. If one pupil is found widely dilated, the other being natural or contracted in size, and if the dilatation be present on the side of the face corresponding to the part of the head injured—in other words, opposite to the side paralyzed (if hemiplegia be present)—it is a sign of the greatest importance.

Under the head of diagnosis of middle meningeal hemorrhage, special notice is given to the following conditions with which it may be confused : 1. Contusion or laceration of brain, especially of the temporo-sphenoidal and frontal lobes, the ecchymosis and consequent softening extending inward to the corpus striatum. 2. Laceration of the lateral or superior longitudinal sinus and extravasation of blood between the bone and dura mater or into the arachnoid cavity. 3. Hemorrhage after injury into the arachnoid cavity. The paper concludes with short sections on prognosis and treatment.

BRAIN SURGERY.

MR. VICTOR HORSLEY (*British Medical Journal*, October 9, 1886) opened a discussion upon this subject at the Brighton meeting of the Association in a very able paper. The paper dealt with the removal of cerebral tumors. The following are among the chief points connected with the operation details. The head must be shaved and very carefully cleansed. The anæsthesia is commenced by a hypodermatic injection of one-quarter of a grain of morphine and is then maintained by chloroform.

The operation is performed and the wound dressed with strict Listerian precautions. The scalp is raised by a semilunar flap. The bone is removed by a couple of trephine holes made at the opposite extremities of the area to be removed. The section is completed by Hey's saw and the bone forceps. The dura mater should be so incised that its edges can be subsequently united by suture. The cerebral tumor is removed by incision. The paper includes an account of three patients from whom portions of cerebral matter were removed with success. These patients were exhibited at the meeting. Justice could not be done to this important subject in the limits of a short abstract.

MICROÖRGANISMS AND ACUTE SUPPURATION.

DR. D. O. KRAUFELD (*Inaug. Diss.*, St. Petersburg, 1886) has contributed a substantial monograph upon this subject. The author's investigations in-

cluded not only a large number (77) of clinical observations of various acute inflammatory processes, but also a series of experiments upon animals. The following is the sum of his conclusions:

1. In the pus in cases of acute suppuration microorganisms can always be demonstrated both by cultivation and by the direct examination of the pus.

2. The microorganisms most commonly met with are *Staphylococcus pyogenes* (aureus, albus, and citreus) and *Streptococcus pyogenes*.

3. The presence and the development of microorganisms in the tissues must be regarded as the principal factor in the etiology of acute suppuration.

4. Traumatism and like "causes" play only a subordinate part in the etiology, and act only as predisposing elements.

5. In infection, the following are the most notable conditions: (a) The quantity of microorganisms introduced. (b) Their collection on one spot. (c) The condition of the infected tissues (*e. g.*, after injury).

6. *Staphylococcus* and *streptococcus* are two entirely different microorganisms, both from a morphological and a biological standpoint.

7. They differ in their cultivation forms and in their relation to the tissues of the organism.

8. *Staphylococcus pyogenes*. In cultivation—a more rapid growth and a good development independent of access of air. In the tissues—a rapid development probably through the medium of the blood.

9. *Streptococcus pyogenes*. In cultivation—a slower growth and a more feeble development, that proceed better without free access of air. In the tissues—a slow development and a localization especially in the lymph channels.

10. In the great majority of acute local suppurations the microorganisms enter through external wounds.

11. In some cases a general infection of the organism occurs through suppurative microorganisms from a distant external lesion.

12. The phlegmon due to *Staphylococcus pyogenes* is especially localized at the seat of the injury.

13. The phlegmon due to *Streptococcus pyogenes* is localized at a distance from the seat of injury following the lymphatics. (The lymph glands have much influence in localizing the process.)

14. Both *Staphylococcus pyogenes* and *Streptococcus pyogenes* can lead to a general infection (pyæmia, septicæmia).

15. In the general infection from *Staphylococcus pyogenes* the collections are especially localized in the internal organs; in that from *Streptococcus pyogenes* in the joints and serous membranes.

16. During the period of the development of the skeleton if there be a general infection from *Staphylococcus aureus* there is a disposition for the collections to be localized in the organs of locomotion, notably in the bones.

17. The inoculation of animals (rabbits) with a pure cultivation of *Staphylococcus pyogenes* leads to acute suppuration with its consequences (pyæmia, septicæmia, spontaneous osteomyelitis) akin to like conditions in man.

18. The suppuration observed under antiseptic dressings must be considered generally to own the etiology of acute suppurations.

IODOFORM POISONING.

FREDERICK TREVES (*Practitioner*, Oct. 1886) contributes a paper on this subject, in which he divides the symptoms into the two following classes:

1. The evidences of poisoning develop very slowly and insidiously. There is malaise and probably some loss of strength, loss of appetite with occasional vomiting, and, above all, the patient is weighed down with a sense of depression. There is usually a moderate degree of fever and an unusually rapid pulse. The sleep is at first broken, and there may be some wandering at night. Headache is not uncommon. In time the patient becomes apathetic and disposed to sleep. He is melancholic; his memory is distorted and impaired; he is troubled by dread of death, or some impending danger, and takes no interest in his surroundings. He remains in a condition of drowsiness; he wastes; he possibly becomes dirty in his habits; his tongue becomes dry and brown; he makes no complaints, and sinks into a more or less complete state of hebetude. Some patients in this condition have lost power in their legs, and all control over their sphincters. Others have been able to be propped up in a chair, and to move about a little until within a short while of death. In the fatal cases the patient becomes weaker and weaker, and in time utterly vacuous. He ultimately dies comatose. If the iodoform be left off, recovery may ensue in time, even when the symptoms have persisted in a marked manner for some time. In this phase of poisoning the progress of the case may be extended over weeks and possibly over months.

2. The symptoms usually develop much more rapidly, and they may indeed appear with some degree of suddenness. There is, perhaps, in the first place some malaise, then complaint of headache, which is often intense, and of vertigo. The sleep is broken, or the patient is quite sleepless. There are excitement and wandering at night. The temperature is high without appreciable cause, and may run to 104° , 105° , or 106° . The pulse is remarkable in its rapidity, mounting often to 150 or 180. There is often albuminuria; the appetite is greatly impaired, and there may be vomiting. The excitement passes into delirium. The patient has hallucinations, sometimes hallucinations of grandeur, and his symptoms may approach those of acute mania. The patient wastes, and becoming more and more prostrated may sink into a comatose condition and die. In not a few examples the symptoms have developed suddenly, and have commenced by sudden fever, or sudden and intense headache, or sudden and unaccountable delirium. In some patients the symptoms have very closely resembled those of meningitis.

Of these two phases of iodoform poisoning, the former may be regarded as the more chronic, the latter as the more acute. The former has been met with more frequently in old or debilitated subjects, the latter in younger and more vigorous patients. It is not to be inferred that all cases of iodoform poisoning will conform precisely to one or other of these phases. The two conditions may blend. In mild cases the disturbance may be quite slight—a little fever, a quickened pulse, a headache, and a restless night, and the poisoning has ceased. Intense headache, with vomiting and great restlessness, may be the only phenomena in other instances. Certain of the symptoms mentioned in the above descriptions may be entirely absent.

The peculiar and very rare exanthem met with in iodoform poisoning is described.

Mr. Treves gives the following as the conditions favorable for iodoform poisoning: The susceptibility of individuals to iodoform varies remarkably. Poisoning would appear to be more apt to occur in old and in young patients than in those in middle life. Symptoms may appear after the first application, or, on the other hand, may not manifest themselves until the powder has been used for weeks. Absorption with poisoning does not appear to be likely to occur from recent wounds unless they are of large size, nor from wounds that are sloughing or suppurating profusely.

The circumstances that would appear most favorable to iodoform poisoning are these: (1) The wound is clean and granulating, and the powder is liberally applied; (2) The iodoform is introduced into an abscess cavity, or into a sinus, or fistula, or confined space; (3) The powder is applied under pressure, or is surrounded by a more or less impermeable dressing; (4) The drug comes in contact with a mucous surface, as is sometimes the case in dressing a colotomy wound.

ACTINOMYCOSIS IN MAN.

DR. PARTSCH (*Deutsche Zeitschrift für Chirurgie*, Bd. 23, S. 498) describes eight new cases of this remarkable disease. In four instances the disease appeared about the lower jaw and in the neck. In three cases it assumed the form of "abdominal actinomycosis." These examples do not present any new features, nor do they differ from the now familiar descriptions of this malady. The eighth case, however, is very remarkable. In this instance the fungus developed in the scar left after extirpation of the breast. The patient was a man of sixty. In June, 1884, there was removed from his left breast an ulcerating carcinoma. The wound sloughed and showed little disposition to heal. Some skin, taken from a young man in sound health, was transplanted upon the wound. It was practically healed by September. In two months' time, however, the scar broke down and an abscess discharged itself. In the pus from this the actinomyces were discovered. All involved parts were excised, and the progress of the disease apparently arrested. There is no clear evidence to show how the wound was infected.

ARSENIC IN THE TREATMENT OF MALIGNANT TUMORS.

DR. KÖBEL (*Über die Arsenbehandlung maligner Tumoren*, Tübingen, 1886) deals afresh with this subject. The treatment was applied to all varieties of malignant disease. The arsenic was taken internally for months in increasing doses, and was also employed locally in the form of a subcutaneous injection. The drug was found to be quite useless in cancer and in round and spindle-celled sarcomata of lymphatic glands. This point had been long established. A cure followed the use of arsenic in one case of multiple and rapidly growing sarcoma, and in many cases of malignant lymphoma. The first-named case is remarkable. The patient was a man aged thirty-six. During a few months no less than four tumors appeared at various parts. One developed in the right axilla, another under the left clavicle, with the result that the bone underwent spontaneous fracture; a third appeared on the acromion, and a fourth about the spine of the seventh cervical vertebra.

Arsenic was administered by the mouth and subcutaneous injections were used. The axillary tumor and that under the clavicle suppurated, and with the evacuation of the abscess the growths disappeared. The other two shrunk away without suppuration. The treatment was kept up for two months, and at the end of this time a new swelling was observed over the back. This was excised and submitted to a microscopic examination. It proved to be a spindle-celled sarcoma. In time recurrence took place in the cicatrix. It was now treated with injections of arsenic. It suppurated and necrosed, and entirely disappeared. At the time of the writing of the paper three years had elapsed. The patient remains well, and there is no sign of a relapse.

In seven cases of malignant lymphoma the use of arsenic was attended with excellent results. The term "malignant lymphoma" would correspond to the more familiar "non-leucæmic lymphadenoma." Dr. Köbel has collected, in addition, 52 recorded cases of this affection in which arsenic was employed. Of these 59 cases the arsenic was administered by mouth and by injection in 30 instances. In 24 administered by mouth only, in 5 by injection only. In 17 cases a cure followed after the treatment had been kept up for from one to six months. In at least five of these patients some recurrence took place at the termination of several months. The growth, however, appears to have again yielded to arsenic. A diminution of the tumor was noted in 14 cases out of the 59. In the remaining 28 cases, the use of the drug was attended with no benefit. There is no doubt that the treatment to be of any avail should be kept up for months, and the arsenic be given in increasing doses. Dr. Köbel's experience is greatly in favor of supplementing the general use of arsenic by local injections.

CYSTIC TUMORS OF THE NECK.

The theory has been frequently urged that certain cervical cysts are developed from lymphatic glands. The direct evidence that supports this theory is, it must be confessed, somewhat scanty. DR. JAKSCH (*Prager Zeitschrift f. Heilk.; Centralblatt für Chirurgie*, July, 1886) furnishes an interesting case bearing on this subject.

The patient, a young woman of twenty-four, had suffered for some time from carious teeth. Two years before she came under observation, a swelling appeared on the neck over the left clavicle. It grew very gradually, and assumed a lobular outline. It was distinctly fluctuating, and proved to be translucent. It more or less disappeared on tapping. It was extirpated. The operation was simple, and the patient left the hospital in twenty-seven days. The macroscopic appearance of the extirpated swelling showed multiple cysts of varying dimensions.

Under the microscope a series of lacunæ were seen that were separated from one another by trabeculæ of connective tissue containing here and there spindle-shaped cells. It appeared to the author very probable that this cyst was developed from the lymph sinus of a gland, and that it had followed a blocking of the lymph stream with breaking down and consequent thinning of the supporting tissue of the gland.

DR. GLUCK (*Deutsche med. Wochenschrift*, 1886, No. 2), in a short paper on blood cysts of the neck, reports the following case: The blood cyst was noticed in the side of the neck of a girl only sixteen years of age. The author has

little doubt that it originated as a "branchial cleft cyst," and that this, in time, effected a communication with the internal jugular vein. Anyhow, it was evident that this vessel communicated with a large cystic cavity. The cyst wall was composed simply of connective tissue. The tumor was excised together with the portion of the vein that it involved. The wound was dressed with iodoform gauze, and the child made an excellent recovery.

DR. PAUL BLOCQ (*Gaz. méd. de Paris*, 1886, No. 12 et seq.) devotes a long paper to an account of cervical cysts. He describes a new variety of neck cyst. It is closely connected with the larynx. He terms it the crico-thyroid cyst, and gives three examples of it.

THE ASSOCIATION OF TETANUS WITH FROSTBITE.

PAUL WAGNER (*Deutsche Zeitschrift für Chirurgie*, Bd. xxiii. S. 542) has published an interesting paper on this subject. It has always been asserted that cold predisposes to tetanus. The observation dates back to the time of Hippocrates, and refers rather to climateric conditions. Lappey, in his account of the Austrian campaign of 1809, wrote: "The wounded who were most exposed to the cold, damp air of the chilly spring night, after having been subjected to the quite considerable heat of the day, were almost all attacked with tetanus." It has not, however, been recognized that tetanus is peculiarly frequent after frostbite, and under these circumstances Wagner's communication will cause some surprise. Between January, 1879, and March, 1886, 164 patients with frostbite were admitted into the surgical clinic at Leipzig. Of these, no less than five—a percentage of 3.4—died of tetanus. The percentage of tetanus observed among the entire series of cases during the period named was only 0.096.

Wagner's statistics further show that only fifteen cases of tetanus were met with in the seven and one-quarter years, so that in no less than one-third of the cases the cause of the disease was—or appears to have been—frostbite. In three of these cases the frostbite was only of the second degree. In the rest it was severe. This communication affords still further support to the view that tetanus depends not upon any spreading neuritis or neurosis, but upon some blood poisoning. Such poison may take the form of ptomaines developed in putrefying parts about a wound. In frostbite this condition would be amply provided for. Most surgeons must have been struck with the fact that in traumatic tetanus the wound is generally foul or sloughing, even though it may be small.

Wagner cites one case especially that bears upon the theory of blood poisoning as a cause of tetanus. In this patient hæmoglobinuria appeared during the last two days of life. The occurrence of this symptom in such recognized blood affections as scarlet fever, typhus, and malaria is well known.

THE DIRECT TREATMENT OF CARIES OF THE CERVICAL SPINE.

DR. A. PODRES (*Russkaja Medizina*, 1886, No. 19) reports the following case: The patient, a lad eleven years of age, had presented for about six months the following symptoms: There were general anæmia and great debility; some slight cyanosis of the face; superficial and irregular respirations with difficulty on swallowing. The upper extremities were a little

wasted and were the seat of some loss of power. The head was kept rigid and was turned forward and to the right. The muscles of the neck were kept contracted. The spinous processes of the sixth and seventh cervical vertebræ were slightly prominent, and pressure upon these points occasioned pain. Extension of the head relieved the patient's breathing and the pains that were felt in the upper limbs. The case was diagnosticated as one of tubercular spondylitis. Dr. Podres resolved to expose the diseased vertebræ. Accordingly, an incision two inches long was made along the posterior border of the left sterno-mastoid near the base of the posterior triangle. The wound was deepened until the cords of the brachial plexus were exposed, and by following these the vertebræ were reached. Before they were exposed an abscess of some size was opened. At the bottom of this the bodies of the sixth and seventh vertebræ could be felt, and it is demonstrated that they were the seat of a superficial caries. All the diseased tissues together with the carious bone were scraped away. The cavity that resulted was well cleaned out and dressed with iodoform. The head was kept at rest in the extended position.

Great and continued relief followed the operation, and at the end of six months the boy was almost well. A sinus, however, remained. To close this a second operation was performed. The carious bones were again gouged, and all unhealthy granulation tissue removed. The sinus soon healed, and the patient made an excellent recovery. The neck remained somewhat stiff, and the head was drawn to the left side.

In this operation the same method was applied to the cervical spine that Mr. Treves, in 1881, applied to the lumbar vertebræ. The procedure has the merit of being founded upon recognized surgical bases—the opening of abscesses at the seat of disease, the removal of ill-conditioned inflammatory deposits, and the provision of free and direct drainage.

EXCISION OF THE COCCYX.

MR. WALTER WHITEHEAD (*Lancet*, 1886, vol. ii. p. 112) gives two examples of this operation. Both the patients were males. In one case the coccyx was necrosed; in the other instance it had been displaced by injury. Mr. Whitehead gives the following *résumé* of his experience of this operation:

“The treatment of coccygeal pain falls under three heads, viz.: 1. By means of rest and anodynes. 2. By complete or partial separation of the bone from its muscular connections. 3. By excision of the bone. As in other cases, our method of treatment must always be guided by the nature of the case. Thus, in those where the pain is due to hysteria or to reflected irritation, owing to uterine or ovarian disease, it would obviously be unsurgical to remove the coccyx. There are, however, a large number of other cases, in which surgical interference will probably be required, and which may be arranged under the following heads: old fractures and dislocations, in which the bone has become fixed in a faulty position, either that of flexion or of extension; congenital elongation of the coccyx; necroses, whether traumatic or otherwise; tumors connected with the coccyx; and finally, a large group of cases of obscure pathology, in some of which there appears to be periostitis of some or all of the segments, in others inflammation of the sacro-coccygeal joint.”

THE PATHOLOGY OF HÆMATOCELE OF THE TUNICA VAGINALIS.

DR. O. RIEDEL's monograph (*Dissertation*, Halle, 1886, S. 51) is founded upon the examination of 21 cases of hæmatocele, all of which were submitted to operation. In 18 of these erosion or partial removal of the tunica vaginalis was practised, while in the remaining 5 cases, on account of atrophy or disease of the testis, castration was performed.

The author comes to the conclusion that the great number of cases of hæmatocele concern a chronic inflammation, which, under repeated irritation, may become acute and recurrent. The theory of the inflammatory origin of hæmatocele is not new. It was first propounded by Gosselin, in 1851. The present paper affords, in all points, a support to Gosselin's theory. According to this view the effusion of blood is not the first step. The tunic is not normal to begin with, but is the seat of false membranes. In about one-third of the bodies of old men examined post-mortem, adhesions are found to exist between the parietal and visceral layers of the tunica. It is evident that inflammation of the tunica vaginalis is very much more common than is usually supposed. The inflammation leads to exudation of plastic matter. This is, of course, vascular. If the vascularization be excessive, blood may readily escape from the newly formed vessels. According to this view, the false membranes so often found in hæmatocele precede the effusion of blood, and are not the result of the hemorrhage, as is very generally assumed.

SUPRAPUBIC LITHOTOMY.

SIR HENRY THOMPSON (*British Medical Journal*, October 2, 1886) opened a discussion upon this operation at the Brighton meeting of the British Medical Association. The great majority of stone cases are provided for by lithotripsy, which has irretrievably superseded lateral lithotomy. For the removal of stones which are much above the average size lithotripsy is not applicable, and in such cases the suprapubic operation is superior to the lateral on these grounds: 1. In the suprapubic operation there are no important structures lying in the line of the incision, or sufficiently near to be rendered liable to injury, either by the knife or the forceps. 2. The space for removing a large stone above the pubes is practically unlimited. 3. There is little or no danger from hemorrhage. 4. The incision is simpler, and the whole operation less difficult and dangerous. 5. During the after-treatment the urine leaves the suprapubic wound more directly, and therefore more safely than it does by the long and lacerated opening made in the lateral operation. 6. Antiseptic dressings can be employed in the former, which are not available in the latter. 7. In the suprapubic operation it is impossible to cut the rectum, to inflict injury on the sexual organs, or to make a urethro-rectal or perineal fistula.

There are two special risks said to attend the operation—one of opening the peritoneum—the other of extravasation of urine around the base of the bladder. The former is virtually non-existent. With regard to the latter the risk is exceedingly small, because it can only happen as the result of unnecessary and unwarrantable interference with the tissues outside the bladder. The author then proceeds to describe the *modus operandi* in detail. He gives eleven cases of suprapubic cystotomy with only one death.

MR. REGINALD HARRISON (*Ibid.*, October 2, 1886) in the discussion that followed this paper was not disposed to endorse Sir Henry Thompson's conclusions. His own experience of lateral lithotomy showed that the reputed risks of that procedure had been over-rated. His mortality in lateral lithotomy was only one in twelve, although he applied that operation only to the quite exceptional cases in which lithotritry was contraindicated. The risk of hemorrhage in lateral lithotomy had been exaggerated. That operation was especially useful in cases of sacculated bladder and in cases complicated with enlarged prostate or cystitis.

The following papers bearing upon this subject may be noted: Two cases of suprapubic cystotomy, by Mr. Pye (*British Medical Journal*, October 2, 1886). One for a large encysted calculus (weighing one-quarter of a pound) in a man of forty-eight—the other for removal of a villous tumor in a man of forty-six: both recovered.

Suprapubic lithotomy, by Thomas Smith (*Lancet*, Aug. 7, 1886). Man aged forty-three. Phosphatic stone with large oxalate nucleus; circumference thirteen inches; weight twenty-four and one-half ounces: excellent recovery.

Suprapubic lithotomy, by Prof. Annandale (*British Medical Journal*, Oct. 9, 1886), who advises the following new method of performing suprapubic lithotomy in male children and adults: 1. The gradual and thorough dilatation of the bladder by the injection of some antiseptic fluid. 2. The introduction of a lithotrite and the seizing and fixing of the stone on its blades. 3. The depression of the handle of the lithotrite so as to press the stone against the abdominal wall immediately above the pubes, in the middle line. 4. Cutting down through the abdominal wall, in the middle line, upon the pubes and just above it, until the bladder is reached. 5. Depressing the handle of the lithotrite still more so as to stretch the wall of the bladder over the stone and make it prominent at the wound. 6. Incising the stretched bladder wall upon the stone to a sufficient extent in a direction downward, and then protruding through the opening of the stone and the blades of the lithotrite. 7. Removing the stone and in withdrawing the lithotrite catching one end of an India-rubber catheter in its blades, and bringing it out through the urethral orifice, the other end being left in the bladder. 8. Stretching the abdominal wound and introducing a drain at its lower end.

Suprapubic lithotomy, by Sir William MacCormac (*Lancet*, September 25, 1886). Boy aged seven. Small mulberry calculus; wound healed by first intention.

Suprapubic lithotomy, by Mr. Barwell (*Med.-Chir. Trans.*, 1886). Two cases. Female aged nine; stone weighing two ounces; recovery. Male aged sixty; protracted recovery.

Encysted vesical calculus of unusually large size, by Mr. Rivington (*Med.-Chir. Trans.*, 1886). Male aged sixty-one. Phosphatic stone weighing twenty-three ounces removed by suprapubic cystotomy; died three months after the operation. The paper concludes with a valuable list of the records of unusually large calculi.

Suprapubic lithotomy, by Mr. H. A. Jacobson (*Med.-Chir. Trans.*, 1886). Male aged nineteen; good recovery. The article concludes with some valuable critical remarks upon the operation in general.

PROPERITONEAL HERNIA.

DR. BARON (*Wiener med. Presse*, 1886, No. 16) reports two examples of this rare form of rupture. The variety is usually described in English text-books as the interstitial or parietal hernia. In these cases a sort of second sac or offset from the original sac extends between the structures composing the abdominal walls. The first example concerns a small inguinal hernia that had been strangulated some days. Herniotomy was performed. On reducing—or attempting to reduce—the gut a like tumor was found above the inguinal canal. When the neck of the primary hernia was opened up a large properitoneal cavity was discovered as large as two fists, in the mouth of which the bowel was incarcerated. A successful reduction was made. The second case was that of an old woman with a strangulated femoral hernia. Herniotomy was performed. After the femoral ring had been enlarged the strangulated loop was reduced. It was now observed that lying deeply in the neighborhood of the hernial orifice was a large properitoneal cavity. This was entered through the femoral ring and it was evident that its aperture was on the abdominal side of that ring. See also case of properitoneal hernia in the femoral ring in a woman of fifty, by DR. TANSINI (*Centralblatt für Chirurgie*, 1886, No. 31).

THE RADICAL CURE OF OBLIQUE INGUINAL HERNIA.

MR. WILLIAM MACEWEN'S ingenious operation (*Annals of Surgery*, August, 1886) for the radical cure of inguinal hernia is based upon the following lines. The sac is carefully separated, not only from the entire inguinal canal, but also from the abdominal aspects of the circumference of the internal ring. It is completely reduced from the canal into the abdomen beyond the internal ring, then thrown into a series of folds, constituting a pad which is placed on the peritoneal surface opposite the internal ring. It there constitutes a boss or bulwark, with its convexity presenting backward toward the abdomen, while its base rests on the abdominal walls surrounding the circumference of the internal ring. The canal having been refreshed by the finger and the handle of the scalpel during removal of the sac therefrom, its walls are brought into direct contact.

The sac is well separated without being opened, and the peritoneum for some little distance around the internal ring is separated from the parietes. The sac is now transfixed with a thread in such a way that where the thread is drawn tight the loose bag is drawn into a series of tight folds. The pad so formed is reduced into the abdomen and lies over the internal ring. In this position it is secured by a suture that penetrates the anterior abdominal parietes. The closure of the canal is effected in the following manner. The finger is introduced into the canal, and lies between the inner and lower borders of the internal ring. A threaded hernia needle is then made to penetrate the conjoined tendon in two places. First, from without inward near the lower border of the tendon; second, from within outward as high as possible on the inner aspects of the canal. One single thread is withdrawn from the needle, and the latter, together with the other end of the thread, is then removed. Another hernia needle, threaded with that portion of the stitch which comes from the lower border of the tendon, is introduced from within outward

through Poupart's ligament and the aponeurotic structures of the three abdominal muscles. The needle is freed from the thread and withdrawn. It is now threaded with the upper end of the stitch, and passes through the three muscles at the level of the upper puncture in the tendon. The two threads are now drawn well together and tied, and so the canal is closed. The author washes the wound with corrosive sublimate solution, and dresses it with iodoform. The steps of the operation are illustrated by some excellent figures. Mr. Macewen has performed the operation in 47 cases. In 14 of these strangulation existed. Not one of the patients has died. The results, so far as the hernia is concerned, are admirable. Seventeen patients have been under observation for from one to five years. Of the 47 patients, only 4 wore any truss after the operation. Mr. Macewen's important paper will be read with the greatest interest. It is doubtful whether any operation for "radical cure" so well deserves the name as the ingenious and well-considered proceeding thus briefly noticed.

EXCISION OF A SARCOMATOUS TUMOR OF THE BOWEL.

NICOLAYSEN, of Christiania, records the following very interesting case (*Norsk. Mag. for Lægevid.*, 1886). The patient was a man of twenty-eight, who was admitted into hospital with an abdominal tumor. The tumor was somewhat kidney-shaped, was to be felt below the umbilicus, was obliquely placed, and appeared to be about twelve centimetres in length. It was a trifling tuberculated, was elastic, dull on percussion, quite movable, and free from tenderness. It was liable to shift its position.

The tumor was first noticed six months after admission, when it was the size of a hen's egg. Before this time certain abdominal symptoms had appeared which had persisted and were increasing in severity. The patient was liable to attacks of colic, and to vomiting after meals. Borborygmi were present. Laparotomy was performed on July 10, 1885. The incision, fourteen centimetres long, was made in the linea alba. The hand was introduced and the tumor drawn out. It was found to concern some seven or eight centimetres of the small intestine, growing especially from the mesenterial border. In the corresponding segment of the mesentery were some bluish-black glands of the size of hazelnuts. A large Spencer Wells's clamp forceps was fixed to the gut on either side of the tumor and about four to five centimetres from it. The bowel on each side of the clamps was again occluded by a small elastic band which was tied round it. The distance between the clamp and the band was about five centimetres. It was in the gap that the resection cut was made. The portion of gut between the clamps was therefore some eighteen centimetres in length, and this was the portion removed. A triangular piece of the mesentery corresponding to the resected segment was also removed with it. The edges of the divided mesentery were united by catgut sutures. The two ends of the bowel were joined then by a series of silk sutures that included only the serous membrane and the muscular coat. The right-hand portion of the gut was then invaginated to the depth of two centimetres into the left-hand portion, and the serous surfaces thus brought together were united by Lembert's suture. Finally, the two elastic bands were removed. The gut was returned into the abdomen and the parietal wound closed. The operation

lasted two and a quarter hours. The patient made an excellent recovery, and six months after the operation showed no relapse of this trouble. The tumor proved to be a myosarcoma or spindle-celled sarcoma.

LAPAROTOMY FOR INTESTINAL OBSTRUCTION AND PERITONITIS.

DR. OBALINSKI reports thirteen cases (*Wiener med. Presse*, 1886, Nos. 4-12), of which the following is a brief abstract:

1. Apparent reduction of a strangulated inguinal hernia; laparotomy on the fourth day; death from peritonitis one day after the operation.
2. Subacute intussusception of the descending colon into the sigmoid flexure. Distinct tumor and well-marked symptoms that had lasted three weeks. The distended transverse colon was opened in the operation and the gap closed by sutures. The invagination was not reduced. Death in five hours. The autopsy showed gangrene of the intussusceptum, rupture of the intussusciptions, and general peritonitis.
3. Intestinal obstruction due apparently to local peritonitis following the ulcerations of typhoid fever. The patient, a man aged fifty-seven, had presented symptoms of local peritonitis for four days. The abdomen was opened, some peritonitis existed about the cæcum. The peritoneal cavity was washed out. Recovery. The nature of this case is very obscure.
4. Strangulation of the small intestine by a band. Laparotomy on the third day. A large loop of the lower ileum was snared. There was peritonitis, with considerable effusion. The gut was liberated and the abdominal cavity washed out. Motion on the fourth day. Recovery.
5. Intussusception. Mild symptoms for five weeks, ending in acute symptoms that had lasted three days. A tumor found on the left side. Laparotomy was performed on this side. The tumor was found to come from the right iliac fossa and to consist of an ileo-cæcal invagination. The reduction was effected with great difficulty, and the serous coat was ruptured in many places. Death from peritonitis on the fourth day.
6. Symptoms of intestinal obstruction following the rupture of the sac in an extrauterine gestation; laparotomy; death.
7. Ulceration of the vermiform appendix due to the impaction of an enterolith. Perforative peritonitis; laparotomy; death in three hours.
8. Cancerous stricture of the sigmoid flexure in a woman of eighty-nine. Symptoms of ileus for twelve days; laparotomy; colectomy; union of the divided bowel with catgut. In nine hours the patient passed a motion, became collapsed and died. The autopsy showed that the bowel had given way at the suture line.
9. Symptoms of strangulation that had lasted three days. An inguinal hernia that was apparently reducible. Laparotomy. A small piece of strangulated gut was found in the inguinal canal and reduced. Recovery.
10. Volvulus of the small intestine. Acute symptoms for three days. Laparotomy; recovery.
11. Perforated peritonitis. Laparotomy; rapid death.
12. Obstruction due to kinking of the bowel by a peritoneal false ligament. Subacute symptoms. Laparotomy; relief of the bowel; recovery.
13. Volvulus of the upper jejunum. Severe purulent peritonitis. Laparotomy; death in ten hours.

Dr. Wahl (*St. Petersburger med. Wochenschrift*, 1886, No. 19) gives the following four cases:

1. Volvulus of the sigmoid flexure. Symptoms had lasted eight days. Laparotomy; replacement of bowel; death in twelve hours. Gut found to be gangrenous. The volvulus was untwisted without difficulty.

2. Intussusception. The patient was fifty-two years of age. Acute symptoms of a typical character had lasted for twenty hours. A tumor was detected. Laparotomy. Ileo-colic invagination discovered and reduced without great difficulty. Death in twelve hours. The autopsy revealed general peritonitis and gangrene of the invaginated bowel.

3. Intestinal obstruction due to an omental band. The patient was a man aged twenty-five, who had been subjected to an operation for the radical cure of hernia. Some omentum was found in the sac and a portion became adherent to hernial orifice. Laparotomy; division of the band; recovery.

4. Symptoms of intestinal obstruction persisting after the reduction of a strangulated umbilical hernia of twelve days' standing. The patient was a woman of fifty-four. Abdomen was opened and enterostomy performed upon the damaged loop of gut. Patient recovered with a permanent fecal fistula. The following papers bearing upon this subject may also be mentioned: Flatau (*Deutsche med. Wochens.*, 1886, No. 6). Laparotomy in intestinal obstruction. Bumstead (*Annals of Surgery*, 1886, p. 136). Case of laparotomy for intestinal obstruction; death. E. Krönlein (*Archiv für klin. Chir.*, 1886, p. 30). "The operative treatment of suppurative peritonitis." A summary of the subject with three cases. E. Ward (*Lancet*, July, 1886). Abdominal section for displaced hernia. J. Duncan (*Lancet*, August, 1886). Laparotomy for rupture of the bladder. R. L. Knaggs (*Lancet*, October, 1886). The operative treatment of chronic obstruction of the small intestine.

IN AMERICA.

UNDER THE CHARGE OF

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LAPAROTOMY FOR GUNSHOT WOUNDS OF THE ABDOMEN.

In *The Medical News* of Nov. 6, 1886 (Proceedings of the New York Surgical Society), DR. W. T. BULL gives a full report of his second successful case of laparotomy for gunshot wound of the abdomen, together with notes of a fatal case, and mention of another which had just taken place.

In the first fatal case the patient, a man of fifty-seven, was seen two hours after shooting himself in the abdomen with a thirty-two calibre pistol, and was already in a condition of profound collapse. Four hours later, no improvement having occurred, in spite of energetic treatment, saline infusion was resorted to, and marked improvement was noted three hours later. The same evening a correct diagnosis of internal hemorrhage, due to wound of the

liver, having been made, laparotomy was performed. The left lobe of the liver was found to be almost cut in two, and before the very free hemorrhage could be checked the patient died.

In the successful case (healthy sailor, twenty-five years of age, shot in abdomen at short range with 38-calibre pistol), laparotomy was performed about two and a half hours after the injury. The bullet had passed entirely through a coil of small intestine, with prolapse of the mucous membrane at the point of exit, but not at that of entrance. These openings, as well as a longitudinal wound of the sigmoid flexure, exposing the muscular layer, and possibly perforating, were closed by the Lembert suture, fine iron-dyed silk being employed. Free venous hemorrhage from a perforating wound of the mesocolon was controlled by a silk ligature passed with a curved needle, and this, as well as an extensive peritoneal abrasion, was rubbed with iodoform. One of the appendices epiploicæ, and about three inches of omentum being found lacerated, were removed. The incision was closed by continuous catgut suture of the peritoneum, with silk and silver wire sutures, including all the abdominal layers, and superficial catgut sutures. Iodoform and carbolyzed gauze dressings were applied, covered by a Lister's coil. The abdominal cavity was washed out with warm carbolic acid solution, one per cent. Although the line of incision suppurated, and a portion of intestine protruded for some days, no peritonitis occurred, and the patient made a good recovery.

At the same meeting, DR. ABBE reported a case of laparotomy for bullet wound of the intestine and bladder, which, however, ended fatally.

We have reported these cases at considerable length, on account of the very small number of successful cases on record. Dr. Bull had been able to find only three (we presume his own previous case, and those of Kocher and Hamilton), to which Dr. Lange added a fourth, recently published in pamphlet form by a German country practitioner. It may be necessary to accept with reserve the case by Griffiths, stated by Adams (*Northwestern Lancet*, August 15, 1885, p. 412) to have occurred during the late war, since it is reported from memory, and not by the operator himself. Still the details are given with precision, and the reporter appears to have been present at the operation. Even if we omit this, the old but unquestioned case of Baudens should, it seems to us, undoubtedly be included in the list.

These operations, moreover, are of special interest, since surgeons are by no means entirely agreed as to the propriety of exploratory laparotomy in all cases of gunshot wound of the abdomen, when no certain evidence of intestinal perforation exists. Dr. Bull seemed to evade an expression of opinion on this subject by stating, in answer to inquiry, that no absolute rule could be laid down; that each case must be judged on its own merits. But we get no hint as to the criteria by which the surgeon may be guided in each particular case. To be consistent, when visceral lesion is uncertain, the surgeon must either invariably pursue an expectant course, or invariably resort to laparotomy. Dr. Bull seemed unwilling, at least in the discussion, to commit himself to either course.

Some of the older and more conservative surgeons will be inclined to ask whether, in the absence of extravasation of intestinal contents, Dr. Bull's cases might not have recovered without operation, and whether there are any cases of recovery following laparotomy in which *fecal* extravasation into the

general peritoneal cavity had taken place *any length of time before the operation*. It must be admitted, however, that the evidence from statistics and experiment is overwhelmingly in favor of early interference in the great majority of gunshot wounds of the abdomen, and Dr. Bull must be heartily congratulated on the skill and courage which have enabled him to conduct a second of these almost desperate cases to a successful termination.

ANTISEPTIC SURGERY.

DR. C. B. PENROSE contributes a short article to *The Medical News*, of October 16, 1886, on "Antiseptic Surgery in the Pennsylvania Hospital." New York surgeons have long been accustomed to hear their visitors from Philadelphia, after watching the painful and elaborate precautions taken to avoid or overcome infection of a wound, declare that they obtained just as good results without such appliances, and that pyæmia and septicæmia were almost unknown in their hospitals. Even in the most recent editions of the text-books of surgery by Gross and Ashhurst the whole subjects of asepsis and antisepsis, which engross so much of the time and attention of surgeons in all other parts of the world, are dismissed with an almost ludicrous brevity.

While the comparative freedom from the more fatal forms of wound-infection in the Philadelphia hospitals is doubtless due in part to the skill of the surgeons, and in part to the scrupulous cleanliness for which their wards have long been noted, it has been easy to learn from current surgical literature that equal success was not attained in avoiding suppuration. Indeed, when we find one of their best surgeons, in a recent work on amputations, recommending that silk ligatures should be used, cut long and the ends brought out at one angle of the stump, it is evident that the writer considered some suppuration inevitable, and, indeed, normal.

We were not prepared, however, for so bad a condition of affairs as is indicated by Dr. Penrose's statement that during four months, in his own ward alone, over a dozen cases of cellulitis of the hand and arm following wounds occurred. With the application of strict antisepsis to a limited number of cases, very much better results were at once obtained, while the remaining cases, treated in the old way (some antiseptic appliances, but no antisepsis), ran the same course as before. A list of seventeen major operations conducted aseptically, during three months, shows very satisfactory results. If a similar condition of affairs exists in any other Philadelphia hospital it is to be hoped that a similar experiment will be promptly tried.

INTUBATION OF THE LARYNX.

Although this subject has already been discussed in the *JOURNAL*, we refer to it again, on account of its great interest both to the general practitioner and to the surgeon. DR. NORTHRUP publishes (*Med. Record*, Oct. 30, 1886) a *résumé* of twelve cases (nine of which had been previously published) in which intubation was practised. The series is of special value as a contribution to the literature of the subject, as in all the cases the diagnosis was confirmed, and the necessity of immediate interference, to relieve the laryngeal obstruction, was recognized by two or more physicians. In all cases the dyspnoea was immediately relieved by the introduction of the tube, and in all but four

the relief was permanent. In these four, death occurred by extension of the membrane to the finer bronchi. Five of the twelve cases recovered.

The introduction of the tube seems to demand about as much dexterity and promptness as would ordinarily be needed for the insertion of the tracheotomy tube in that operation; and the presence of the instrument, in one case, for six days, does not seem to have had any injurious effect. So far, then, we are encouraged to a more extensive trial of this comparatively simple method.

PROF. MONTI, of the Vienna Policlinic, has been in the habit, for many years, of showing a number of hard-rubber tubes, which he introduces for the same purpose. He seems, however, to have considered them usually as merely a temporary expedient, to be used when tracheotomy could not be performed immediately. Still he has left them in place for twenty-four hours or more. Here the end of the tube protrudes from the mouth, an arrangement obviously less secure and more likely to excite irritation than that introduced by Dr. O'Dwyer.

LAPAROTOMY FOR PERITYPHLITIC ABSCESS.

DR. HOMANS reports a successful case of laparotomy for perityphlitic abscess (*Boston Med. and Surg. Journal*, April 29, 1886). The patient, a boy of eleven, was first seen after suffering from pain and tenderness in the right iliac region for four days, and the operation was performed the next day. The incision was made over the most tender point, the peritoneum opened, and coils of healthy intestine which presented were pushed aside. An abscess, shut in by recent intestinal adhesions, was opened by breaking these up with the finger, and about two ounces of offensive pus evacuated. The cavity was drained, and the patient recovered.

As these abscesses, though usually intraperitoneal, can almost invariably be opened at a point where adhesions to the abdominal wall have occurred, or, if the operation be undertaken too early for this, by passing behind the cæcum, without opening the general peritoneum, laparotomy would seem to introduce an unnecessary element of danger, especially as the abscesses frequently contain fecal masses. Laparotomy would seem to present advantages only if it were intended in every case to attempt resection of the vermiform appendix in order to guard against the not infrequent recurrences.

THE COMPARATIVE FREQUENCY OF ORGANIC STRICTURE IN THE WHITE AND COLORED RACES.

DRS. W. P. MCINTOSH and H. R. CARTER furnish extensive statistics (*New York Medical Journal*, Nov. 13, 1886) from the record of the U. S. Marine Hospital Service, tending to show that gonorrhœal strictures of the urethra occur much less frequently in negroes, in proportion to the number of cases of gonorrhœa, than in white men. They conclude that about one urethral stricture occurs to twenty-three gonorrhœas in the negro, and one to eight in the white. Gonorrhœa seems, moreover, to be more frequent among negroes than among white persons, but to run a milder course.

There is a general impression that the genital organs of the negro are proportionally larger than those of the white man, though they are not aware that any exact observations have been made on the subject. A series of careful

measurements would, however, be of value to determine whether the average urethral calibre is larger in the negro. Were it so, we might find here at least a partial explanation of the different courses which the disease seems to run in the two races.

SUBIODIDE OF BISMUTH AS A DRESSING.

In *The Medical News*, of October 9, 1886, DR. A. S. REYNOLDS makes extraordinary claims for subiodide of bismuth as a perfect dry dressing, especially in chronic ulcerative processes. We are always somewhat suspicious of very enthusiastic reports in regard to new remedies, and Dr. Reynolds's hypothesis as to the mode of action of the drug seems fanciful. Yet if it accomplishes one-quarter of what is claimed, it should take a high rank as a surgical dressing.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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ANÆSTHESIA OF THE RETINA.

M. H. PARINAND, in *Annales d'Oculistique* for July and August, 1886, contributes an interesting paper upon retinal anæsthesia. He would limit the term to that particular type of amblyopia without special lesion or ophthalmoscopic sign, primarily characterized by a lessened sensibility to the stimulus of light, whether chromatic or achromatic, and proceeding generally from the periphery of the retina to the centre. A strange diagnostic symptom of this condition is incidentally noted: the fact that photophobia almost always accompanies it. The author allies this with the cutaneous phenomenon of painful anæsthesia, and calls attention to the common error of considering this consensus of clinical signs as indicating a hyperæsthesia.

More narrowly specializing the features of this anæsthesia, the author sets forth the following points: 1. The concentric contraction of the visual field for compound or white light, which condition may persist for years, and to such a degree that the total field may be comprised within five degrees, or the amblyopia may invade the macula and result in complete amaurosis. 2. Dyschromatopsia, or contraction of the field for colors, is constant. Generally, the order of disappearance is, first, violet, then green, blue, and red, consecutively. The persistence of red is noted, because in tabetic and alcoholic dyschromatopsia this color is the first to give way. The transposition of the circles of red and blue is also remarked, the blue field, normally more extended, becoming smaller than that of the red. More notable still is the remark that it sometimes happens that certain colors are perceived as such, or as grays, with a less luminous intensity than is required to bring achromatic stimuli to

the threshold of perception. 3. Visual acuity, or perception of form, is diversely implicated and difficult to make out, since this is largely dependent on refractive errors; but it is affirmed that a normal acuity often coexists with a pronounced amblyopia, and a visual field narrowed to forty or thirty degrees, and even with a reduced central luminous perception. This contrasts sharply with the amblyopia of optic atrophy where a normality of luminous perception often coexists with a considerable reduction of visual acuity. 4. Monocular diplopia or polyopia often accompanies this form of retinal anæsthesia, though wholly due to disorders of the refractive media.

The inception of this malady is not remarked by the patient, and its continuance and progress may likewise be unnoticed. It may also be said that in the usual examination of patients by ophthalmological surgeons, it would never be suspected by patient or physician, since, with direct or central vision, achromatic stimuli of full intensity are almost the only method and means of the ordinary test. Everything, indeed, seems to indicate that the customary ocular examinations are crude and insufficient. Wearying and tiresome as these may be to the ophthalmic surgeon, it is plain, for example, that the diagnosis of the affection under discussion could not be made at all without a measurement by photoptometers of the sensibility of the retina to different intensities of stimuli, both chromatic and achromatic, and in all parts of the field.

But to return to our author. The persistence of the disorder is remarkable when the fact that it is a functional trouble is considered, but the greatest distinction consists in the etiology. In contradistinction to such diseases as consist in pathological conditions of the end-organs, the rods, cones, and visual-purple of the retina, of which hemeralopia is the typical example, this form of retinal amblyopia always springs from the nervous centres, and is usually a concomitant of hemianæsthesia, and particularly of the hysterical type of hemianæsthesia. The author, however, would guard against the entire confounding of the two types, contending that the term hysterical amblyopia is not conterminous with anæsthesia of the retina. The cutaneous anæsthesia is sometimes limited to the parts surrounding the affected eye,¹ and, whether limited or general, may be the result of a local or general trauma. In this connection "the railway-spine of American physicians" is considered a symptom of a general neurosis, and not as a spinal type of the same.

The value of the recognition of this affection (general retinal anæsthesia) consists, besides its import to the physiologist and to abstract science, in the indications it gives of more primary and central disorder, itself being purely symptomatic and secondary. The fundamental hemianæsthesia may be either hysterical in origin, or due to toxic or other lesions at the cerebral centres. An interesting side-light is here thrown on the relations of the cerebral hemispheres. In 400 or 500 cases of hemianæsthesia examined by the author no case of hemiopia occurred, thus proving the justice of Charcot's remark that the coexistence of general amblyopia and hemianæsthesia argues a connection of each retina *in its totality* with the opposite cerebral hemisphere. This, as is well known, is opposed to the view of von Gräfe. In reply to the objection that the amblyopia is often binocular whilst the hemianæsthesia is uni-

¹ See Fox and Johnstone on temporal reflex, Medical News, March 8, 1884.

lateral, the author thinks this arises from a failure to recognize a lessened and subnormal sensibility of the supposably normal side. The color-student will find in the article many interesting facts. For example, the following the disputed question of the binocular fusion of two complementary colors, the author adduces this astonishing fact that when one of these colors was thrown upon the retina affected with chromatic anæsthesia to this color, the fusion nevertheless took place in many cases, precisely as if both eyes had been normal—that is to say, an eye insensitive to green with normal perception of red, behaved under the excitation of green synchronously with that of red to the other (and normal) eye, so far as the resultant unity of chromatic sensation was concerned, just the same as a normal or green-perceiving eye would behave. In the same way an eye anæsthetic to one of the complementary colors covering two-thirds of a Maxwell disk, nevertheless recognized the resultant white when the disk was rotated. The complexity of retinal and cerebral interconnections is thus emphasized.

HEMIANOPSIA.

In the *Journal of Nervous and Mental Disease* (New York) for January, 1886, DR. E. C. SEGUIN gives a succinct tabulation, with a masterly *résumé* of the lessons to be gathered from the same; of the 46 reported cases of hemianopsia, the cases are grouped as follows: 4 were indefinite or useless for the study of localization; 3 produced by pressure upon optic tracts or chiasm; 6 due to lesion of the corpus geniculatum laterale, or the thalamus opticus, or both; 12 caused by lesion of the white substance of the occipital lobe; 5 traumatic lesions of the occipital region of the skull; 16 lesions of the cortex, or of the cortex and subjacent white substance.

The objects sought from the study are, of course, two-fold: 1. The diagnostic value of hemianopsia alone or joined with other symptoms such as cutaneous anæsthesia, hemiplegia, etc., as pointing out the position and nature of the cerebral lesion. 2. The location of the psychic centre for vision. Concerning the latter point the views of Munk and Ferrier are alone considered as authoritative; according to Munk, this centre, as is well known, is held to be in the occipital lobes, each visual area having connections with both retinae. Ferrier held it to be in the angular gyrus. The conclusive cases of the table show Munk's view to be the more trustworthy, and the author finds reason to harmonize the more general position of the two investigators by calling attention to the route of the optic fasciculus of Gratiolet and Wernicke, which, as it passes close under the inferior parietal lobe of the angular gyrus on its way to the occipital lobe, is extremely liable to be severed or interfered with by any injury to the angular gyrus, whence may have arisen Ferrier's error. Charcot's view of a second decussation of the lateral fasciculi through the corpora quadrigemina is discarded as wholly inconsistent with the clinical facts, and it is intimated that Charcot himself has abandoned it, so that the famous diagram, except as history, may now disappear from the text-books. An illustration of the course of the optic tracts without secondary decussation beyond the chiasma is shown, with the ultimate psychic centre for vision located in the cunei and subjacent gyri of the occipital lobes. The following diagnostic laws are tentatively offered by the author as a result and summary of the teachings of the whole discussion:

1. Lateral hemianopsia always indicates an intracranial lesion on the opposite side from the dark fields.

2. Lateral hemianopsia with pupillary immobility, optic neuritis, or atrophy, especially if joined with symptoms of basal disease, is due to lesion of one optic tract, or of primary optic centres on one side. This diagnosis may be further strengthened and rendered quite certain by seeking for and finding one-sided pupillary reaction, as recently suggested by Wernicke. He ingeniously predicts that one lateral half of each iris will be found to contract by the reflex effect of light when one optic tract has been interrupted. He designates this as "hemiopic pupillary reaction."

3. Lateral hemianopsia, or sector-like defects of the same geometric order, with hemianæsthesia and choreiform, or ataxic movements of one-half of the body without marked hemiplegia, is probably due to lesion of the caudolateral part of the thalamus, or of the caudal division of the internal capsule.

4. Lateral hemianopsia, with complete hemiplegia (spastic after a few weeks) and hemianæsthesia, is probably caused by an extensive lesion of the internal capsule in its knee and caudal part.

5. Lateral hemianopsia, with typical hemiplegia (spastic after a few weeks) aphasia if the right side be paralyzed, and with little or no anæsthesia, is quite certainly due to an extensive superficial lesion in the area supplied by the middle cerebral artery; we would expect to find softening of the motor zone and of the gyri lying at the extremity of the fissure of Sylvius, viz., the inferior parietal lobule, the supra-marginal gyrus, and the gyrus angularis. Embolism or thrombosis of the Sylvian artery would be the most likely pathological cause of the softening.

6. Lateral hemianopsia, with moderate loss of power in one-half of the body, especially if associated with impairment of the muscular sense, would probably be due to a lesion of the inferior parietal lobule and gyrus angularis, with their subjacent white substance, penetrating deeply enough to sever or compress the optic fasciculus on its way to the visual centre.

7. Lateral hemianopsia without motor or common sensory symptoms. This symptom alone is due, I believe, from convincing evidence, to lesion of the cuneus only, or of it and the gray matter immediately surrounding it on the mesial surface of the occipital lobe, in the hemisphere opposite to the dark half fields. Most surgical cases come at once, or after convalescence, within this rule, or in 6.

In all cases coming under 3 to 7 inclusive, the pupils react normally; and rarely does the ophthalmoscope show any lesion of the optic nerve, except, of course, in some tumor cases, when neuro-retinitis may be expected. In the August number of the same periodical Dr. Seguin reports nine cases of hemianopsia in which no post-mortem examination existed to confirm the results of the study of the cases previously examined. Pathological diagnoses are put forward according to the analysis of previous cases submitted to post-mortem investigation. Two notable symptoms are discussed: the existence of hallucinatory images in the half fields that had just become blind, explained as the irritation of the cortical visual centre just previous to its destruction; the preservation of central vision in all cases of hemianopsia, the hemianopic half field always stopping short just without the macula.

THE "RATIONAL METHOD" OF AFTER-TREATMENT OF CATARACT OPERATIONS, IRIDECTOMIES, ETC.

This method consists in the rejection of bandages, compresses, and the dark room, and the substitution therefor of a strip of isinglass plaster applied to the lids and an ordinarily lighted room, the other conditions as to rest, etc., remaining as before, or according to the individual judgment or habits of the surgeon. These seem extremely radical changes of the routine treatment laid down by von Gräfe, and, with the few exceptions to be noted, universally followed by the profession. The advantages claimed for it by its supporters may be briefly classified as follows:

1. General. No special room is required; if in a private house, no artificial darkening; if in a hospital, the common wards may be used. Better ventilation, sanitary surroundings, and comfort are secured. The patient's friends or nurse may be with him in more cheerful conditions, may read to him without weak artificial light, etc. The long and dreaded period of darkness is obviated, the discomfort of a close bandage over the eyes is avoided, the inflammatory weakening and unhealthy effect of this padding and warmth to the lids and adjacent tissues done away with.

2. The examination of the eye is easy and thorough, and an earlier discovery of bad results is secured. This is chiefly because the eye, being in receipt of its natural stimulus all the time, does not become photophobic, and a more frequent and accurately thorough examination is at all times possible. Incipient inflammation, œdema of lids, etc., is detected, the secretions, such as tears, discharges, etc., are not pent up in the already suffering eye, but have at all times a natural and ready drainage through the not rigidly joined palpebral fissure. The introduction of mydriatic, myotic, or antiseptic medications is at all times easy, without any disturbance of dressings.

3. Dangerous complications and sequelæ are evaded. Even the lightest, most uniform, and carefully applied bandage must exercise a certain pressure upon the front of the globe; it would not be a bandage did it not do so; and a body as soft and pliable as the globe must be somewhat flattened, regularly or irregularly, as the case may be. But however little this pressure, asymmetry of the cornea must result, and with the inevitable result that coaptation of the lips of the wound is not perfect. Hence, two serious and persistent evils—prolapse and entanglement of the iris in the wound, and, after recovery, astigmatism—are avoided.

4. The period of confinement is shortened, and, from the absence of photophobia (assiduously cultivated by the old method), the duration and comfort of that of convalescence is rendered more desirable; whilst the tests and application of spectacles are sooner reached, followed by the earlier resumption of the ordinary habits of life.

The practical application and introduction of the method to the profession are due to DR. CHARLES E. MICHEL, of St. Louis, who sets forth his reasons for adopting it, and the results of twelve or fifteen years of practice, in *Knapp and Schweigger's Archives* for September. From Michel, DR. CHISOLM, of Baltimore, learned the method, and, adopting it enthusiastically, reports his success in *The Maryland Medical Journal* of June 19th, and in the June number of *The American Journal of Ophthalmology*. Lastly, DR. SIMEON

SNELL, of Sheffield, England, being struck with the reasonableness of the plan as described by Dr. Chisolm, adopted it in his own practice, and bears witness to its value in *The Lancet* for September 18th.

Dr. Michel gives no definite statistics of his cases, but says that, "as the results were so uniformly satisfactory from the very first, I have never deemed it worth the time or labor of making out a statistical statement for comparison." Dr. Chisolm states that the results of 24 cataract operations, 8 iridectomies and 7 capsulotomies were most gratifying, and "brilliant illustrations of this simple treatment." Snell reports 18 cases in hospital and private practice, and, quoting Chisolm, endorses these words: "The revolution in the after-treatment of cataract and iridectomy patients in this hospital is complete. From this time forth, all bandages, compresses, and dark rooms will be among the things of the past, to be remembered only for the discomfort they occasioned." As to the plaster, each operator uses a different size and shape, Michel wisely urging that a large one communicates the motions of the face in chewing, speaking, etc., to the eye. He uses a strip of gold-beater's skin, one-half inch wide by one and a quarter inches long, over the palpebral fissures, leaving the latter loosely joined.

PROF. THOMSON has banished dark rooms and thick compresses from the Ophthalmological Department of Jefferson Medical College Hospital since its opening in 1877. The patients are placed immediately after an operation, done with antiseptic precautions, in the open wards of a general hospital; the soft texture of a black knit, wool or silk bandage, with one thickness of patent lint placed over the eyes, is all the protection given. The above method has proven so satisfactory, both to the personal comfort of the patient and visual recovery, that at a future time full statistics of his cases will be published. We may mention that in the last series of one hundred cases, but two can be placed upon record as total losses, one by panophthalmitis the other by iridocyclitis which may yet be benefited by a future operation.

It will be seen that the "revolution" is based upon the fundamental axioms that light is the natural stimulus of the eye, and that the lids are its natural splints. So far, therefore, as the application of these principles is consistent with the absolute demand for rest, the method seems to deserve its chosen epithet, "rational."

CHROMATIC SENSITIVENESS OF THE PERIPHERY OF THE RETINA.

In *Gräfe's Archiv*, xxxii. 1, DOBROWOLSKY gives the results of extended and careful experiments to determine the precise measure of the relative sensibility of the peripheral portions of the retina to chromatic stimuli. He finds that exercise increases the sensibility, though at one sitting these parts of the retina are very soon fatigued. Fraunhofer line C was chosen for red, D for yellow, E for green, F for cyan-blue, and G for indigo-blue. The greatest sensitiveness is at the fovea, falling rapidly toward the periphery. At the centre a difference of $\frac{1}{840}$ of the intensity of red was detected; 5° inward $\frac{1}{248}$; 20°, $\frac{1}{129}$; 35°, $\frac{1}{112}$; 50°, $\frac{1}{85}$. 5° outward $\frac{1}{161}$; 20°, $\frac{1}{105}$; 35°, $\frac{1}{74}$. Similar reductions took place with the other colors, the sensitiveness of the outlying field being relatively less for each color as the centre was less sensi-

tive to the color, though the rapidity of falling off was not the same for all colors. At 5° inward, sensitiveness to red and green fell by $\frac{1}{4}$ whilst to yellow $\frac{1}{2}$, to blue $\frac{1}{8}$; 5° outward the retina had lost $\frac{1}{4}$ of its sensitiveness to red, $\frac{1}{3}$ to green, $\frac{1}{7}$ to yellow and blue; 50° inward sensitiveness to red had decreased to $\frac{1}{4}$, to yellow to $\frac{1}{8}$, to blue to $\frac{1}{8}$. Taking the sensitiveness of the fovea to yellow as the unit of comparison, the relative sensitiveness of the centre to red is $\frac{1}{3}$; to green, $\frac{1}{10}$; to blue, $\frac{1}{44}$; to indigo, $\frac{1}{7}$. Comparing a single color, the centre being $\frac{1}{3}$ as sensitive to red as yellow, it is found that 5° inward it is $\frac{1}{3}$; 20° , $\frac{1}{6}$; 50° , $\frac{1}{57}$; externally $\frac{1}{54}$, at 5° ; $\frac{1}{3}$ at 20° $\frac{1}{35}$ at 35° .

ORIGIN OF STRABISMUS.

In *Knapp and Schweigger's Archives* for September, 1886, PROF. J. STILLING advances an explanation of the origin of strabismus that must in a practical sense be considered as highly important. As a result of many tests and examinations the author finds the natural position of rest of the eyeballs (as, e. g., in dreamless sleep) to be, as a rule, one of convergence in emmetropia and hyperopia, of divergence in myopia. Exceptions to this rule are, however, numerous; "parallel strabismus" is somewhat rare.

The position of rest is determined by the shape of the orbital cavity, the relations of the fibrous and soft structures to the globe, the position of entrance of the optic nerve, etc., but more especially by the muscular and refractive conditions. Squint in hyperopia is not due to the refractive condition as such, but to the fact that when the effort of binocular fixation is given up the eye returns to its natural position of rest, which is, as has been shown, one of convergence. The prevalence of divergent squint in myopia is explained in the same way; the position of rest of non-squinting myopic eyes is generally one of divergence. The practical bearing of this perception of the facts lies in the common failure to differentiate between physiological squint (the position of rest) and pathological strabismus. For example, when an eye is covered by the hand and thus excluded from binocular vision, it passes to its position of rest—a physiological condition that is often diagnosed as pathological. Whether it be so or not is discoverable by the aid of prism tests alone.

Distal abduction in normal eyes is usually from 4° to 6° ; adduction from 14° to 24° . Abduction of more than 6° and adduction of less than 12° are held to be abnormal. The chief obstacle to squint for ametropic eyes, the reason that it is not oftener developed, is, therefore, the same as for emmetropic eyes, viz., the inherent desire for and preponderance of binocular vision; this results in a continuous struggle of the ocular muscles to bring about the common fixation against natural obstacles. If an eye finds itself, from weakness of its muscles, from anisometropia or from a consensus of these and other numerous well-known causes, unable to keep up this struggle, binocular vision is relinquished and the eye passes to its condition of rest with the result called strabismus. But it may again be emphasized that a temporary return to its position of rest, while covered or disused, may be purely physiological and require no surgical or therapeutic interference.

CILIARY CORRECTION OF ASTIGMATISM.

In the *Annales d'Oculistique* for July and August, 1886, DR. GEORGE MARTIN, with an abundance of evidence in the shape of reports of clinical cases, proves the fact of the compensation, to a limited degree, by the ciliary muscle of astigmatic irregularities of refraction. He distinguishes two varieties of this neutralization of corneal asymmetry; a permanent condition, consisting in a certain persistent tension of the muscle, and a variable contraction which appears when the desire for clearness of vision calls it forth. The first he calls the resistant, the second, the elastic contraction of the ciliary muscle. The author strongly and justly urges the employment of the Javal and Schiötz ophthalmometer as a certain means of learning in advance the existence of corneal irregularity, otherwise both patient and physician are put to the extreme inconvenience of extended atropinization only to learn that no astigmatism exists. Having detected the presence of the defect, the author finds whether it is resistant or elastic by the subjective examination before the distant letters. If the amity is normal, without correcting lenses, and if the correcting lenses are borne without more perfect amity, it shows that the lenses represent the play of the muscle in the elastic variety of compensation. Thorough atropinization alone reveals the resistant tension; as a matter of fact, the two varieties usually coexist. If the mydriatic reveal a greater astigmatism than the ophthalmometer showed, it proves the existence of lenticular astigmatism. But this latter type is extremely rare, corneal asymmetry constituting, almost without exception, the total astigmatism; when the crystalline is affected, it is found to be of the same kind as that of the cornea, so that the one is only an addition to the other. In emmetropes the strongest resistant contractions are 1.25 D., rarely 1.5 D.; the greatest elastic contractions are 0.75 D.; the average combined correction of the two usually is about 1.25 D. Resistant contractions in myopes are very seldom found, and of elastic, the author has found but two cases. Among hypermetropes the resistant tension is the stronger, and sometimes reaches the degree of 1.25 D., whilst the elastic does not rise above 1 D., the combined average commonly amounting to about 1.5 D. From the clinical cases reported it may indirectly be seen how dangerous and imperfect is the attempted correction of refractive errors without the use of a mydriatic, hypermetropic astigmatism, *e. g.*, frequently masking as myopic astigmatism, or *vice versa*.

The author calls attention to the frequent existence of such general ocular disorders as palpebral cysts, lachrymation, asthenopia, phlyctenular ophthalmia, blepharitis, etc., existing as the direct result of the unequal strain put upon the ciliary muscle in its attempts to neutralize the imperfect focalization of corneal asymmetry. But the most noteworthy fact of this kind is the existence of *astigmatic keratitis*, a condition that is too often overlooked by ophthalmologists.

HEAT THE RETINAL INTERMEDIATE OF LUMINOUS SENSATION.

In the *American Journal of Ophthalmology* for July, 1886, appears an article by L. WEBSTER FOX and GEORGE M. GOULD, the object of which is to forward the hypothesis that the essential nature of the retinal function is a refined and delicate temperature-sense. They hold that the

older theories of light and color perception are illogical, not based upon experiment, and mutually destructive. Each and all are founded on the fallacy of the specific or differentiating function of the retinal end-organs, a theory that in other departments of physiological inquiry has been thrown aside. The authors consider the office of the retina in this respect to consist simply in the reception of the ethereal stimuli by the pigmentary layer into which the points of the rods and cones extend, and a transformation of the ethereal wave energies into its own molecular activity to heights or degrees precisely correspondent to the amplitudes or energies of the ethereal vibrations. The rods and cones register the height of this aroused molecular energy, and transfer by ordinary neural methods these registrations to the cerebral coördinating centres, where alone light and color are produced. The authors examine in detail arguments and corroboratory data drawn from the sciences of physics, physiology, chromatology, psychology, and pathology, but reliance is placed especially upon the physical law that the kinetic value of the ethereal stimuli can only become mechanical or neural in setting up molecular activity in particles of which the vibratory period is consonant with their own. The absolute energy of the ether-wave is too slight to produce work in any other manner. If this be so, they say, our measure of molecular activity is always in terms of heat-units; heat or temperature is the common name for such motion. It appears that this ingenious theory was worked out in ignorance of the fact that others had previously and tentatively advanced the same fundamental hypothesis—notably Swan M. Burnett, who, so long ago as 1881, rightly judges that a consensus of investigators arriving independently at a common understanding, argues a fatal defect in the older theories.

At first sight, the matter seems to possess only a purely theoretic or scientific interest, but, as is suggested, there is no truth once established but finds unexpected practical applications, and it is not difficult to see that experiment and investigation on the lines opened out by this thought may lead to decidedly useful results in reference to color-blindness and various retinal affections.

OTOLOGY.

UNDER THE CHARGE OF

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THE ORGAN OF HEARING IN LEUCÆMIA.

DR. GIUSEPPE GRADENIGO, JR., of Padua (*Archiv für Ohrenheilkunde*, Bd. 23, S. 242-263, July 15, 1886), has contributed an interesting brochure on this subject. The only case of profound affection of the organ of hearing, in consequence of leucæmia, heretofore fully described, both clinically and pathologically, is that of Politzer, presented at the Otological Congress, at Basle, in 1884. The other cases reported are given in their clinical aspects only.

According to the statistics of Vidal and Isambert, in ten per cent. of the cases of leucæmia there occur aural symptoms of a specific form. This percentage, however, is regarded by Gradenigo as perhaps too high. It is also very probable that aural affections are not as numerous as ophthalmic diseases in leucæmia.

The observations of Gradenigo were made upon a leucæmic subject with splenic disorder, who, in the last days of his life, manifested undoubted signs of hardness of hearing. His case was one of mixed leucæmia, with hemorrhagic diathesis, petechiæ upon the backs of the hands, hemorrhages from the bowels, and epistaxis. There were alterations in hearing in both ears, and death occurred from exhaustion. After obstinate epistaxis, which lasted for eight hours, occurring after the patient had been under observation for two weeks in the hospital at Padua, he experienced tinnitus aurium. Ten days later there was noted considerable hardness of hearing in both ears, which had been developed within a few hours. Two days subsequent to this the tuning-fork was perceived only when placed on the skull. The watch was heard only when placed on the auricle. In the left ear, whispering, 0; conversational tone heard 10 centimetres. In the right ear, whispering, 0; conversational tone, 15 centimetres.

After catheterization of the right Eustachian tube there was entire cessation of the noises in that ear, and an increase of hearing for the watch to 8 centimetres. Two days later, the patient complained of hearing worse, especially in the left ear. Inspection of the left ear revealed the presence of a grayish-red mass, extending across about one-third the lumen of the auditory canal. Syringing removed numerous red layers of epidermis, and a small clot of blood. A closer inspection showed that the aforesaid mass consisted of a subepidermal vesicle, containing fluid and coagulated blood, situated on the lower end of the canal, and stretching toward both the anterior and posterior level. This vesicle began about the middle of the cartilaginous part of the auditory canal and extended almost to the edge of the membrana tympani. The latter was reddened and swollen, the short process being the only part of the malleus remaining visible. The membrana tympani was greatly retracted, and its lower half appeared brownish in color, without distinctly defined outline, as though there were in the drum-cavity a blood-clot. In the right auditory canal there was a dark red, hemorrhagic spot on the anterior wall.

The diagnosis now made was "Otitis media chronica bilateralis, with recent hemorrhagic exudation in the external and middle ear."

During the subsequent few days there were epistaxis, evanescent petechiæ on the belly, and a gradual loss of strength. The deafness, however, seemed to diminish markedly. Death occurred in six weeks, being preceded by a recurrence of hemorrhagic diarrhœa.

Post-mortem examination of the drum cavities revealed in them the presence of a gelatinous yellowish-red substance which filled these cavities, and extended backward and toward the mastoid cells. The fluid pressed from this mass showed, under the microscope, both red and white blood-cells, varying in size, but containing no crystals of cholesterin or fat cells. The mass disappeared in fibrous texture. Further and later examination revealed the presence of new-formed connective tissue, containing hemorrhagic infiltration and remnants of free extravasations. The examination of the internal ear

gave a negative result, so far as concerned the presence of a leucæmic exudation.

The results of Gradenigo's investigations are summed up as follows:

1. In the course of a leucæmic process there sometimes occur in the organ of hearing complications which depend upon exudative processes in the middle ear or in the internal ear.

2. Such exudations may ensue independently of a hemorrhagic diathesis.

3. Either a previous or a simultaneous inflammatory process must be regarded as the essential predisposing factor in the aural complications.

ABSCESS OF THE BRAIN FOLLOWING OTORRHOEA—CURED BY OPERATION.

The patient, in this instance, was under the surgical care of Dr. Schede, in the General Hospital of Hamburg. The notes were collected by DR. MAX TOEPLITZ, and published in the *Archives of Otology*, Sept. 1886, vol. xv. pp. 176-185. In this case, as in that of Schondorff, alluded to by the writer (*Monatsschr. f. Ohrenheilk.*, 1885, No. 2), there was a well-defined, very painful spot on the skull, œdema confined to the same limit, and a fistula. The fistula, in Toepplitz's case, led no further than under the scalp (galea) into a rough place on the outside of the bone, while in Schondorff's case it led directly to the brain, and indicated the way by which pus had escaped. It is asserted that Schondorff's case is the only other one reported cured.

The patient, a man, twenty-eight years old, had had a suppuration from his left ear for six months preceding his entrance into the hospital, January 11, 1885. His hearing had gradually decreased, and he began to look icteric. He complained of a painful spot on the top of the head; formerly he had had vertigo; a chill four days previous. The auditory meatus was narrowed to a small transverse fissure; at the fundus the field was red, shining, and protuberant. Incision into the meatus and the red protuberance at fundus. Patient had a pyæmic appearance. Treatment of the ear after incisions was by syringing and dressings of lead-water.

Jan. 13. The dressing contained a small quantity of fetid pus. The subjective symptoms were good. Remission of headache, but the temperature rose. Treatment: Sulph. quin., 0.5 gr., in three doses.

14th. Dressings are dry. Pain again on top of the head and in the occiput. On account of the rise in temperature, Dr. Schede opened the mastoid by chiselling off the cortex, which was thickened by hyperostosis. After reaching a depth of five millimetres, thick, cheesy, offensive pus escaped from the cavity, on a line with the linea temporalis, about one and a half centimetres behind the external meatus. Syringing through the external meatus brought away large pieces of cholesteatomatous pus through the opening in the mastoid. Drainage was maintained, and the wound packed with iodoform gauze. The dressings were changed daily.

16th. The wound looked well and there was no febrile reaction. The fever remitted. The subjective symptoms were good.

24th. The evening temperature 38.6° C., with moderate pain between vertex and temple. The dressings were changed and the wound syringed through the external meatus.

27th. A notable elevation in temperature to 39.6° C. The dressings covered

with fetid pus. The wound filled with fresh granulations; the latter were removed to facilitate syringing.

28th. Temperature continues high. The opening in the mastoid was enlarged and energetically syringed; a thin strip of gauze was then inserted into the wound.

29th. Paresis of the *right* half of the face appeared over night, and the right angle of the mouth hung down obliquely; the tongue, when projected, deviated to the right and trembled. The patient was unable to contract his lips. Fluids were taken without difficulty. Both eyes were closed with equal facility. The patient showed a peculiar impediment of speech, using but few words, saying mostly "yes" and "no," mixing right words with erroneous ones, and reading in a stuttering voice; a word impulse which pleased once, would return repeatedly in his talk; his memory became defective, and he forgot his children, his name, and his age.

30th. High degree of aphasia. Dressings changed morning and evening. Syringing with 1:1000 sublimate solution. The bandages were now always wet through with pus. There was now observed slight œdema behind the ear, which greatly increased the next day.

The diagnosis of *brain abscess* was then made, and preparations for an operation instituted. The incision for chiselling the mastoid was extended upward about eight cm., and slightly backward. After detaching the galea and its periosteum, there was found, about three cm. behind and above the external auditory meatus, a drop of pus, "the size of a pin's head," protruding from a small fistula in the bone. After chiselling off an extremely thin and fragile piece of bone the size of a quarter, the dura was seen to be covered with red, button-like granulations. Pressure revealed distinct fluctuation. An exploratory puncture was made, which, however, resulted in the escape of only a trace of fluid with brain-fibres. At the same time, pieces of caseous matter, exceedingly offensive, came away continually from between the dura and the bone, and also small quantities of foul air. The incision was then extended downward and backward five cm., and the thin bone was further chiselled off. Again large quantities of pus were discharged, thinner than before, but equally offensive. An exploratory puncture at this point disclosed the presence of pus. After slitting the dura, about a cupful of pus escaped, and the sharp spoon (used as probe?) entered six cm. without reaching the wall of the abscess. The abscess was about the size of a small orange. Syringing with sublimate solution (1:1000) brought out a quantity of matter interspersed with flakes of brain-matter. Drainage of the cavity of the abscess was maintained, and dressed with sublimate gauze. The partly narcotized patient was able now to move the left orbicularis muscle, but not the right one. The patient passed the first few days almost entirely in sleep, then recovered rapidly, the fever having ceased. The impediments in speech did not quickly abate. Dressings always contained fetid pus in abundance.

Feb. 11. The patient up at his own request, and becoming more active. A slight weakness of his left leg passed off rapidly; speech improved.

12th. Drainage tube removed. A round spot of the dura mater, one and a half inches in diameter, was bulging and visibly pulsating.

19th to 21st. Vomiting after meals. Pulse only 60. Patient became dull, assumed a pyæmic appearance, and seemed collapsed at night.

22*d.* A portion of the dura, the size of a hazelnut, bulged outward, and was very resistant to pressure. After an incision, upward and backward, a quantity of thin, fluid, very fetid pus issued from this region.

Temperature remained normal, the patient recovered rapidly, and his physical functions reappeared. He quickly tired, however, after reading, writing, and, especially, ciphering.

March 23. Discharged from the hospital, and treated as an out-door patient.

In two months he returned with fever. The abscess was again opened and drained. After a week's drainage, the patient got up and left the hospital, cured. The wound healed completely in about three weeks. As late as October 16th, five months subsequent to this treatment, though he spoke fluently, the patient was unable always to recall a word promptly when desiring to use it.

It is remarked that the abscess was probably situated in the region of the second left temporal convolution. The diagnosis was based, 1, upon the œdema confined to the region already named; 2, upon the painfulness which existed there, and which became very great on pressure; 3, on the paralysis of the right facial nerve, and upon the peculiar impediment in speech.

The diagnosis is difficult, as some features are common to all three above-named conditions. A differential diagnosis is aided by the fact that meningitis generally begins suddenly. High fever, delirium, vomiting, stiffness of the neck, are then developed in meningitis, whilst symptoms of abscess in the brain come on slowly, on account of its frequently prolonged latency.

The symptomatic points in brain-abscess have already been given. Thrombosis in the lateral sinus is characterized by painfulness along the sternocleido-mastoid muscle, and especially by a swelling of the external jugular, which can be easily felt. Later, chills and high temperature may set in, great œdema of the throat develops, and paralysis of the vagus and glosso-pharyngeus is also described as likely to ensue.

DERMATOLOGY.

UNDER THE CHARGE OF

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THE TREATMENT OF LUPUS BY LOCAL APPLICATIONS.

As stated by UNNA (*Lancet*, Sept. 25, 1886), the fact that the mechanical treatment of lupus is rarely sufficient to ward off recurrence, is ample justification of experimental attempts to transform the treatment into one of medical application. In using salicylic acid plasters in lupus cases for the removal of the cuticle preparatory to the employment of more destructive

agents, the writer noted that the salicylic acid plaster alone had a favorable influence on the new growth; and if strong plasters were employed, not only was the horny layer separated from the patch, but the tubercles themselves were destroyed and removed. This observation led to the use of salicylic acid in a series of lupus cases, without the assistance or subsequent use of any other remedy. The results were good. The lupoid deposits are destroyed, and the healthy interstices left untouched. The drawback to its use, however, was in the unavoidable pain which it causes when applied to thin epidermis and especially to raw surfaces. The pain is considerable, and lasts as long as the plaster remains on. In various experiments to obviate this, the addition of creasote (pure beech-tar creasote is required) proved the most valuable. In fact, this addition to the salicylic acid plaster rendered the application practically painless. It is only during the first ten or fifteen minutes that this compound plaster gives rise to any pain, and this may be avoided by painting over the raw surface a four per cent. solution of cocaine. The applications were made in the form of plasteryulls.¹ These plasters were employed in various strengths. Those containing 10 grammes of salicylic acid and 20 grammes of creasote to the one-fifth square metre suffice for ordinary cases of lupus of the cheeks and nose.

For lupoid nodules embedded in old sclerosed scars, and in the warty form of lupus, stronger plasters are required, 30 to 50 grammes of the acid and 50 grammes of creasote to the one-fifth square metre of plaster. The thinner the epidermis and the better supplied with capillaries a tissue is, the less salicylic acid is required. Besides its property of dulling pain, the creasote has another value—its antiseptic power. The strongest plaster suitable for the case should always be employed at the commencement, changing once or twice daily, and cleansing the parts at each renewal; as soon as the lupus nodules have fallen out, it is discontinued and a weaker plaster used. When the lupus deposits seem totally destroyed, simple healing remedies may be employed. The author considers this the simplest possible form of the treatment of lupus, the salicylic acid causing a continual exfoliation of the affected area, and the creasote rendering the process painless, and having as well a destructive action on the bacilli. The resulting scars are smooth, but the redness lasts somewhat longer than with other methods.

THE TREATMENT OF LUPUS BY ERASION.

In *The Practitioner* (Oct. 1886) STOWERS relates his experience in the treatment of lupus. According to the author's observation, lupus is more intimately associated with phthisis and destructive pulmonary disease than is generally allowed. In fifty-two per cent. of his cases the notes showed that phthisis occurred in one or more members of the family. This being the case, the importance of proper constitutional treatment, in conjunction with the more positive external measures, is evident. Erosion, by means of the curette, has, in the author's hands, given satisfactory results. The operation, except in those cases in which the disease is superficial and very limited, is best done

¹ Plasteryulls consist of a very thin sheet of gutta-percha, coated on the one side with an adhesive substance (aluminium oleate) containing one or more medicinal substances, and backed on the other side with mull (undressed muslin).

under ether, as then the cell-growth may be the more carefully and thoroughly scraped out, and good after-results secured; with cocaine, as a local anæsthetic, either as painted over the parts or injected subcutaneously, the writer's experience has been unsatisfactory. As soon as the bleeding has stopped, and the parts are freed of the coating of serum by means of lint or blotting-paper, thorough cauterization with the nitrate of silver stick follows. Subsequently a dressing of carbolized oil (1 in 40) is employed, being renewed twice daily; under this healing takes place. As new foci of disease appear, recourse is immediately to be had again to the curette. This method of treatment leaves eventually a pale and insignificant scar; and of the many plans familiar to the writer he has found none so efficient as that here described.

MOLLIN: A NEW SOAP PREPARATION AS A VEHICLE FOR CUTANEOUS MEDICAMENTS.

KIRSTEN (*Monatshefte für praktische Dermatologie*, No. 8, 1886) has had prepared a soap in which there is present an excess (17 per cent.) of the fatty constituent. To this the name "mollin" (mollinum) has been given. The exact formula is as follows: 100 parts fat, 40 parts lye (both potash and soda lye, chiefly the former), to which, when saponification has about taken place, 30 per cent. of glycerine is added. It is of a dull white color, of ointment consistence, stable, unirritating, and permits of even and thorough application without the addition of water. In this last property lies its superiority to similar soaps already introduced. Its main use, rubbed up with mercury, is to be found in the treatment of syphilis by inunction, as a substitute for blue ointment. In comparison it is cleanly and of more positive therapeutic effect. Another equally valuable combination is mollin with styrax for the treatment of scabies; it is applied in the same manner as an ordinary ointment, but has the advantage of being easily removed by simple washing. Various other drugs, such as tar, sulphur, ichthyol, chrysarobin, salicylic acid, etc., may also be advantageously prescribed with this preparation.

TROPHONEUROSIS OF THE SKIN CAUSED BY INJURY TO THE MEDIAN NERVE.

TILDEN reports (*Journ. Cutaneous and Venereal Diseases*, October, 1886) a case of nerve injury which was followed by peculiar cutaneous symptoms. The wound, seated at the wrist, healed satisfactorily. Several days after the injury there developed a progressive loss of tactile sense and a numbness of the fore and middle fingers. Some days later, and subsequently at intervals of a few weeks, on the same parts, pea-sized, tense bullæ, with clear serous contents, appeared. The bullæ develop rapidly, without subjective symptoms, upon a slightly reddened base, and, once formed, do not increase in size. On removal of their covering is seen a superficial excoriation which soon disappears. When several such lesions have appeared on the same spot a condition of tylosis is brought about. One of the bullæ, the largest noted, gave rise to an ulcer which subsequently was transformed into a crater-like callus, the thickened epidermis being arranged in concentric rings around the crater, which presented a small blood-crust covering an excoriation. The skin over the fingers named is tense, whitish, of a glossy texture, and on palpation the

tissues seem to be more resistant and less elastic than those of the uninvolved fingers. The nails were not implicated. The application of the faradic current relieved the symptoms considerably while under treatment, but the improvement was not permanent.

A PEMPHIGOID ERUPTION FROM POTASSIUM IODIDE, WITH FATAL TERMINATION.

The notes (*Berliner klin. Wochenschrift*, 1886, No. 35) of a case of poisoning by iodide of potassium, are contributed by WOLF. The patient, a female, aged forty-eight years, was under treatment for subacute nephritis, and she had so far recovered from the attack as to permit release from bed, and other privileges accorded to the convalescent. At this time potassium iodide was ordered, a dose of six grains four times daily. At the end of the first day, as subsequently learned, feverishness and headache were experienced. In spite of these symptoms the patient on the following day took three doses, but, in consequence of the violent coryza and the appearance of a white blister on the bridge of the nose, the drug was discontinued. On the next day the writer saw the patient, the first time since the potassium iodide had been prescribed. The face presented a shapeless, puffy appearance, and from between the swollen eyelids was discharged a thin, brownish pus. Over the face, head, and neck were seen papules and pustules, and bullæ, the last-named being present in predominant numbers.

The papules and pustules were apparently of the same character as the ordinary iodide acne so commonly seen. The bullæ were of variable size and shape some of a grayish-white, and others of a reddish or bluish-red appearance, the latter filled with a bloody, or sero-sanguinolent fluid. They were seated upon normal or œdematous skin, and mostly round or oval, but in some places, from confluence of several smaller lesions, they were large and irregularly shaped; more scattered, but also with their characters more clearly shown, could be seen similar bullæ upon other parts of the body. With the majority of the blebs the size was about that of the thumb-nail. In some respects, the bullæ, in their general aspect, resembled those seen in gangrene. There were no positive subjective symptoms, the feeling of heat at first experienced having disappeared.

The pemphigoid eruption did not confine itself to the skin, but involved the mucous membrane of the nose, mouth, throat, and, apparently, the larynx. An examination of the secretions and excretions failed to give any evidence of iodine. Temperature and pulse-frequency were slightly increased. On the following (the fourth) day the condition was about the same, except there was slight diarrhœa, the stools showing the presence, in moderate quantity, of blood. No new outbreak of lesions occurred. The floor of the ruptured or broken blebs was covered with a whitish, macerated, smeary-looking substance. On the face the blebs gave way to tolerably deep ulceration. An examination of the heart disclosed a systolic murmur. Under gradual but rapid collapse, death took place on the ninth day. There was no autopsy.

A CASE OF BULLOUS ERUPTION FOLLOWING THE ADMINISTRATION OF SALICYLIC ACID.

An example of an eruption of a bullous type, following the administration of salicylic acid, is given (*Deutsche medicinische Wochenschrift*, No. 33, 1886)

by ROSENBERG. The patient was a robust female, who applied for treatment for acute rheumatism. At a former attack, some months previously, according to her statement, salicylic acid was employed, but in spite of its favorable effect on the rheumatism, its discontinuance was deemed advisable in consequence of a macular eruption to which its use gave rise. On account of the severity of the rheumatic pains at the time of coming under the writer's care, salicylic acid, four grammes in the course of the day, was prescribed. This had a positive effect on the pains, but produced a feeling of intense heat in the skin, an œdematous swelling of the eyelids, a turgescient condition of the face, and a bluish-red macular eruption; there was also a marked elevation of the temperature. The same quantity was given the second day, but in consequence of the intolerable burning in the skin the patient opposed its further administration. A day later, on account of the return of the rheumatic pains, the remedy was again given, three grammes in the day. The burning feeling in the skin, the elevated temperature, and a fresh outbreak of the bluish-red macules resulted. Many of these macules developed into blebs. A change of treatment was then instituted.

The blebs, which were whitish, and for the most part on the back and extremities, were seated upon a red basis, and varied in size from a ten cent piece to a half dollar. In shape they were rounded, but occasionally their form and size were changed by confluence of several of the individual lesions. The contents were of a clear yellowish color, and gave an alkaline reaction. The bullous eruption developed three days after the first dose of the acid had been given. Not only was the skin the seat of the macules and blebs, but also the mucous membranes. Three days after the medicine had been discontinued, the eruption began to decline, the blebs drying to crusts, and the macules becoming paler and assuming a brownish tinge. The turgescient condition of the face disappeared, followed by a branny desquamation which subsequently involved the whole body. Later, with the patient's consent, the salicylic acid was again administered, and the same eruption developed, proving beyond doubt that the drug was responsible for the cutaneous disturbance.

With the object of determining whether the salicylic acid was excreted by the skin, chemical examination of the contents of the blebs was made, but with negative results. Experimentally a small quantity of salicylic acid lanolin salve was repeatedly rubbed into the skin; no general symptoms followed, but at the place of application macules, identical to those called forth by the internal administration of the acid, appeared. This result, the author states, seems to prove that the eruption was due to the direct irritative action of the salicylic acid circulating in the blood upon the skin.

THE ETIOLOGY OF PSORIASIS.

BEISSEL makes the statement (*Monatshefte für praktische dermatologie*, No. 9, 1886) that in microscopic examination of the scrapings of the part immediately overlying the papillary layer of the skin in psoriasis patches, he has found a fungus apparently corresponding to that which Lang has called attention. Experimental inoculation with this fungus (obtained by culture) produced an intense hyperæmia at the points of inoculation, which, after a

day or two, began to fade; there then formed a small reddish areola immediately around the inoculated part, on which a distinct, well-marked scaling was noted to occur. Such lesions remained for several weeks, and then, after repeated soap-washings, disappeared. The author believes, therefore, that this fungus is an important etiological factor in this disease.

THE IODOFORM RASH.

As stated by TREVES (*Practitioner*, October, 1886), the extensive use of iodoform in the past few years in the treatment of wounds has resulted in a number of examples of iodoform poisoning from absorption. In a proportion of the cases, as met with in one of the author's cases, a general skin eruption was one of the toxic symptoms. According to recorded cases of poisoning by iodoform, this symptom is comparatively rare; but it is possible that in some instances it may be overlooked or misinterpreted. It is a definite eruption, as are the eruptions that follow the internal use of iodine, or iodide of potassium. There are, indeed, two eruptions which its use may call forth. The one, however, is entirely local in character, due to the direct action of the iodoform, consisting of a vesicular eruption upon an inflamed and œdematous surface—a dermatitis, in fact, and may possibly depend upon some impurity in the drug. The other eruption, and that of which the author especially writes, is due to its absorption, and consists essentially of erythematous patches of general distribution. The patches, which are usually well defined, may be simply erythematous in character, non-elevated, or they may consist of minute, closely aggregated papules, seated upon a pinkish-red base (as in the author's case), or they may be sharply circumscribed, raised, and bright red, not unlike urticaria. The eruption due to the local irritating action of the drug may be produced by one application; that due to absorption makes its appearance after the drug has been employed for several days or longer, and then usually after or along with other toxic symptoms.

THE TREATMENT OF KELOID AND HYPERTROPHIED SCARS BY ELECTROLYSIS.

In the treatment of these disfigurements, HARDAWAY (*Medical Times*, May 29, 1886) contributes his experience with electrolysis. The first case was that of a woman who had been treated elsewhere for the removal of superfluous hair with caustic injections in or near the hair follicle, with the sole result of a large number of irregular hypertrophied scars. In the endeavor to remove the hairs, now twisted and tortuous, by electrolysis, it was necessary to plunge the needle in and about the distorted follicles. As treatment progressed it was found that, in addition to the permanent removal of the hairy growth, the scars were smoothed out, and finally became flat. In the second case there was an elevated radiating scar upon the forehead, following an electro-cauterization for the removal of a port-wine mark. In this instance the smoothing down of the growth as a result of treatment by means of electrolysis was striking. In a third case, a patient aged thirty, there was a keloidal growth on the right side of the chest, a few inches below the clavicle,

as large as a silver half-dollar, and a fourth of an inch in height. The keloid was the seat of constant pain and burning. The electrolytic needle was at various times plunged into the surface of the growth and through its base. As a final result there was left, in place of an elevated keloidal tumor, a small white scar scarcely raised above the level of the skin.

ERYTHEMA MULTIFORME: ITS NATURE AND TREATMENT.

The conclusions regarding the nature and specific treatment of this disease reached by VILLEMIN from a study (*Bulletin de l'Academie de Medecine*, 1886, No. 20) of personal cases may be briefly stated as follows:

That the affection is a general disease of a specific nature, and that the cutaneous phenomena, as well as the usual accompanying pains and swelling in and about the joints, are merely symptomatic—the joint symptoms being in no way related to rheumatism, as generally supposed. And, in the matter of treatment, that the potassium iodide, in the quantity of about thirty grains daily, has a specific action, exercising a surprising influence on the disease in the course of twenty-four to forty-eight hours.

SCARLATINA AND SCARLATINIFORM ERUPTIONS FOLLOWING INJURIES AND OTHER OPERATIONS.

I. E. ATKINSON (*Journ. Cutan. and Ven. Dis.*, Oct. 1886) lends his aid toward simplifying the subject of scarlatinoid eruptions following injuries and operations. These eruptions, for the most part, are due to the scarlet fever poison, and are, in fact, as generally recognized, true scarlatina. As observations by others, and also by the author, show, however, many of these rashes are due to other causes. In support of this may be mentioned the septicæmic rash, the scarlatinoid eruptions following the ingestion of certain drugs frequently administered at, or subsequent to, the time of the operation, etc., and which are not infrequently accompanied by general systemic disturbance and a reddened and painful condition of the throat.

The points brought out by the paper, the writer thinks, justify the following conclusions: 1. Unprotected persons who have suffered injury, or who have undergone surgical operations, are rather more liable to scarlatina than the unprotected healthy. This increased liability is probably due to diminished power of resistance from disease, and will probably hold with regard to other specific fevers. Scarlet fever is more apt than the other exanthemata to attack such persons, because its influence is usually more widespread, and because it varies within such wide limits that it often escapes the attention of those who readily detect other infectious disorders, and provide against them. 2. When an epidemic tendency of the symptoms we have been considering to prevail after injuries and operations is shown, it may be concluded with confidence that true scarlatina is present. 3. Septicæmia is occasionally accompanied by a scarlatiniform rash which does not depend upon the scarlatinal poison. 4. Medicinal eruptions, especially those from cinchona and its preparations, not infrequently follow injuries and operations. These rashes are, for the most part, usually attributed to true scarlatina or septicæmia.

MIDWIFERY AND GYNECOLOGY.

UNDER THE CHARGE OF

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THE PREGNANT AND PARTURIENT UTERUS.

This contribution by SCHRÖDER and his pupils (*Contributions to the Anatomy and Physiology of Obstetrics*, edited by Professor Schröder, with the coöperation of Drs. Hofmeier, Ruge, and Stratz. Bohn: Cohen & Sohn, 1886) comprises the description of a frozen section of a case where death took place at the beginning of the first stage: a description of the anatomy and physiology of the lower uterine segment by Hofmeier, and a consideration of the physiology of the second and third stages of labor by Schröder and Stratz. At present we omit the abstract of Ruge's paper. Hofmeier's views have been already given in this journal for July, 1886, p. 273.

The first section, by SCHRÖDER and STRATZ, is that of a patient who died four hours after admission to hospital, and where labor was only advanced as far as the early part of the first stage. The foetal heart was not heard, and the membranes were unruptured. On vaginal examination, the os uteri was found dilated as large as the palm of the hand, the small fontanelle to the left, and the sagittal suture in the transverse of the brim. The general condition of the patient was hopeless, both lungs being cedematous, urine half albumen, and a systolic murmur at apex. The abdomen was greatly distended. The whole body was frozen, sawn in the mesial line, figured, and special drawings given of the interior surface of the uterus and of the foetus. In the sagittal section the special interest centres on the conditions of the lower uterine segment, cervical canal, and pelvic floor.

Cervical Canal. The anterior wall measures 3.7 centimetres, and the os internum is sharply marked off from the uterus. The posterior wall of the cervical canal is drawn up so that its lower tip is 3.4 centimetres distant from that of the anterior wall. The posterior wall of the cervical canal is elongated to about 5.5 centimetres. In this way, the antero-posterior diameter of the os internum is 4.8 centimetres. Above the os internum, in front as well as behind, the uterine wall is especially thin. This is the stretched lower uterine element, whose upper boundary, the contraction ring, is 5.5 centimetres above the os internum in front, and 3.5 centimetres behind.

In this patient, therefore, the first effect of labor was to canalize the lower uterine segment and cervical canal, and to give measurements as follows:

Os externum to os internum.			Os internum to C. R.		
In front	.	4.2 centimetres	+	5.5	= 9.7 centimetres.
Behind	.	5.5 "	+	3.5	= 9.0 "

This confirms Chiari's statement (v. p. 000), and shows that Braune's os internum, his contraction ring, and his cervical canal, are really cervical canal plus stretched lower uterine segment. The plate of the internal surface of

the uterus shows the membranes separated up to the contraction ring, and the placenta diminished in area, but not separated.

The application of these statements is now made in the article on the "Physiology of the Stages of Labor." According to Schröder and Stratz, the uterus at the end of pregnancy is made up of three different parts, viz., the part of the uterus capable of retraction, the lower uterine segment, and the cervix. The lower boundary of the first part is where the peritoneum becomes loosely attached, and where large veins are met with on section. Below this is the lower uterine segment, where, during labor, we have no active contraction. The boundary between lower uterine segment and the active portion of the uterus is the contraction ring, while the os internum separates lower uterine segment and cervix. By uterine retraction, the contraction rings rises, and the lower uterine segment and cervical canal open up from above down. The capacity of the retracting portion of the uterus diminishes, and the uterine contents are driven into the expanded lower uterine segment and cervix.

It is remarkable that during labor, while the child is being driven down, the fundus uteri remains high and at the same level, viz., toward the right side, usually, and below the ribs. The authors explain this by asserting that the descent of the child is the result of its elongation and the separation of its breech from the fundus uteri. To prove this they give the results of measurement and palpation. They assert that while the first stage is completed by uterine retraction, the second is finished by intra-abdominal pressure alone. As Ahlfeld has shown, the doubled-up child in utero measures half its length when extended. This position of the child is not due to uterine pressure but is primary. Before labor, the uterus takes the shape or impress of its surroundings, but during labor it becomes rounded, the long diameter shortening, and the transverse and antero-posterior becoming greater. This shape, however, also depends on the primary shape of the uterus, whether fusiform or arcuate. In the latter the transverse diameter preponderates, and the fundus may have a median depression.

Measurements of the fetus during labor give results which can only be explained by supposing that the fundus is not in contact with the breech. This space is filled with liquor amnii or the feet of the fetus. Drawings are given to illustrate this. The authors point out also that usually the uterus is rotated on its long axis, the left angle of the fundus being toward the front, and that, owing to the right lateral obliquity of the uterus, the contraction ring is higher on the left side and the left round ligament more elongated than the right.

In regard to the mechanism of the third stage they hold that Schultze's mechanism is the more usual, but that Duncan's may occur in some cases. As to the management of the third stage, they recommend waiting until the placenta is driven below the contraction ring, and then suprapubic pressure to help when necessary.

[While there is very much that is valuable in Schröder's work, the proof as to the breech of the child leaving the fundus during the second stage seems incomplete, and is not borne out by any sections. The statement that during the second stage the uterus is not a factor, is novel, but is not supported by sufficient evidence. Granting even that the breech has left the fundus and that liquor amnii lies between, why should not the uterine retraction act on

the child through the waters? The account of the third stage mechanism is not what is held in this country and ignores many facts to the contrary.—Ed.]

TUMORS COMPLICATED WITH PREGNANCY.

STRATZ (*Zeitschrift für Geb. und Gynäk.*, Bd. xii. Heft 2, S. 262) gives the statistics of the cases of tumors complicating pregnancy in the Berlin Hospital, under Schröder's charge, since April 1, 1886. The tumors considered are ovarian, fibroid, and carcinomatous.

1. *Complication of ovarian tumors with pregnancy.* Of these there were 19 cases. In 5, the complication was at labor; one mother died, and only two children were rescued. In the 14 where the complication was met with during pregnancy, no mother died and 13 children were saved.

The 5 cases met with in labor were as follows: 1. Frau K., twenty-five years old; fifth labor. Labor long, and a face case. Child died soon after birth; mother recovered. 2. Frau K., twenty-four years old; primipara. Patient sent into hospital after labor, which was long. Ovariectomy seven weeks post partum; mother recovered. 3. Frau M., twenty-four years old; second labor. Received into clinic after labor. Diagnosis, "ovarian tumor, ascites, and peritonitis." The tumor had been twice punctured during pregnancy, fever following the second tapping. Labor long. The tumor was removed three weeks after labor, and the patient died in three weeks from septic peritonitis. 4. Frau B., twenty-eight years old, and primipara. Tumor in pouch of Douglas, and pregnancy at tenth month. Reposition of the tumor under anæsthesia and induction of labor were had recourse to. Mother recovered and living child delivered with forceps. 5. Frau D., thirty years old; primipara. Long in labor, and with right-sided ovarian tumor. Forceps could not be applied, and uterus ruptured during attempt to turn. Recourse was had to perforation. The tumor was not punctured. Patient recovered after three months' illness.

The results given are thus unfortunate, only one patient making a normal recovery. The fifth case had a very bad puerperium—only one child was fully developed, and could not be born alive. Of the three premature, only one survived.

From statistics of Litzmann, Playfair, Wells, and others, Stratz finds a total mortality of 30 per cent. for the mothers. Later results, however, are better, and it is possible, as Olshausen suggests, that only specially difficult cases are published.

2. *Complications with ovarian tumors during pregnancy.* Of these there were 14 cases, in all of which ovariectomy was performed. In all, the mother recovered; one aborted from peritonitis; a second, where the operation was difficult, aborted seven weeks after the operation, the child being at the sixth month and living. It is to be noted, however, that in this case the uterine sound had been used before the operation. A third and difficult case had premature labor at the eighth month, five days after the operation. Twelve children (once twins) were born at full time. The results are thus much better than those collected by Olshausen, viz., 8 deaths in 82 cases.

Stratz discusses the question as to whether ovariectomy is the best treatment, and whether it should be done in all cases, and comes, of course, to the con-

clusion that it should be employed always. This has been long held in Great Britain. He mentions specially a case where Pippingsköld, of Helsingfors, performed ovariectomy successfully seven hours before labor. Tapping complicates a case always, the mortality being 19 to 50 per cent. (Fock and Peaslee). It should be an aphorism, therefore, that the complication of an ovarian tumor with pregnancy indicates ovariectomy.

3. *Complications of myomata with pregnancy.* Twelve cases are recorded where difficulties occurred. Of these, no mother died, but a living child was delivered but twice. Of the 12 cases, 1 is still under observation, and thus 11 have full results. Of these there was spontaneous interruption of pregnancy in 4 cases; in 3, abortion was induced; twice, the pregnant uterus and tumor were removed; 1 myomectomy, and 1 enucleation per vaginam were performed. In the last two cases, living children were born. The myomectomy was performed on a pedicellated fibroid, and the enucleation on a fibroid of the anterior lip. Thus maternal mortality was *nil* and 18 per cent. of children saved.

4. *Complications of myomata with labor.* There were 13 cases; of these, 7 mothers died (53.8 per cent.), 2 had had bad puerperia, and only 4 passed a normal puerperium; 8 of the 13 children were saved (61.5 per cent.). Fibroids are thus much more difficult to recognize and treat, and the induction of abortion seems the best method of treatment, unless in special instances.

5. *Complications of carcinoma with pregnancy.* Five cases were noted. 1. Carcinoma portionis; supravaginal amputation. 2. Carcinoma portionis, and four months' pregnancy; supravaginal amputation; abortion four days after operation. 3. Carcinoma portionis; abortion. 4. Carcinoma portionis; four months' pregnancy; supravaginal amputation and abortion followed. 5. Carcinoma of anterior lip; amputation and premature labor about three weeks after (nearly seventh month). Thus no maternal death and no full-time birth.

6. *Carcinoma complicated with labor.* Seven cases are given. Mortality to mother, 4 immediately after birth, and 2 in consequence of it. Four living children were obtained. Treatment was as follows: Case 1. Sectio Cæsarea. Case 2. Turning; child macerated. Case 3. Forceps; child living. Case 4. Spontaneous birth, followed by supravaginal amputation three weeks after. Case 5. Spontaneous birth; supravaginal amputation three weeks after. Case 6. Cross birth; turning. Case 7. Sectio Cæsarea, and Freund's operation; mother died in an hour.

CONTRIBUTION TO PORRO'S OPERATION.

KLEINWÄCHTER (*Zeitschrift für Geburtsh. und Gynäk.*, Bd. xii. Hft. 2) considers the fact that we have already a history for Porro's operation, now scarcely ten years old, a proof of the rapid rate of life of the present time. He first takes up the history of its proposal in 1876 by Porro, and that of the various modifications by Müller, Litzmann, Veit, and others, as well as the attempts by Fehling, Heusner, King, Schmalfuss, to alter the extraperitoneal treatment of the stump. The opposition of Sänger's revival of the old Cæsarean section and his alteration especially in regard to the method of suturing the uterine wound is very briefly alluded to.

In judging of the value of Porro's operation, Kleinwächter points out that

it may be done unnecessarily—*e. g.*, on moribund women; on those dying from œdema of the lungs; in rickety pelvis, with a conjugate of 7.8 cm. ($3\frac{3}{5}$ inches). It is but fair to take the mortality of Porro's operation in suitable uncomplicated cases, and then it will be found to be small. Osteomalacia cases are specially suited for Porro's operation owing to the favorable influence on the disease that the removal of the uterus exerts. This has been granted even by Sänger.

Kleinwächter believes osteomalacia to be endemic in certain parts, and in the Austrian province of Bukowina he has seen several cases. In two of these he performed Porro's operation.

Case I. Patient was a Jewess who had a normal labor in 1876, and suckled her child two years. A second birth occurred in 1878; this child was suckled for one year and a half. During her third pregnancy she was not well, having severe pains in her back, sacrum, and legs, and found walking troublesome. Her third labor was difficult and long. After this she altered notably, became smaller, and could only drag herself along with difficulty. Suckling again lasted a year and a half. She menstruated for the last time on January 20, 1884, and now became much worse and unable to walk.

Kleinwächter was summoned to her labor on November 1, 1884, and found an anæmic, ill-developed woman, with the most wretched surroundings possible. The special pelvic measurements were as follows:

Between the spines	23.5 cm.
" " crests	26.75 "
" " trochanters	25 "
External conjugate	18.5 "
Between ischial tuberosities	3.75 "

The condition was evidently osteomalacic. On internal examination the promontory was found deep in the pelvis, the pelvic ring compressed laterally and antero-posteriorly, and the pubic bones and ischia so crushed in that a finger could scarcely be passed. Behind the ischial tuberosities two fingers could be inserted. The foetal head could be touched per vaginam with the greatest difficulty; the cervical canal admitted the finger, and the membranes were intact. Cæsarean section was thus imperative.

The abdominal incision was easily made, and, after the peritoneal cavity was opened, it was extended to five centimetres above the umbilicus. As the intestines were kept back with difficulty, Kleinwächter was afraid to try Müller's modification, and accordingly opened into the uterus *in situ*. The child, a girl, was seized and brought out—right arm, left arm, breech, and lastly head, and was alive. The bleeding from the uterine wound, owing to the position of the placenta there, was considerable. The placenta was removed, the uterus turned out of the abdominal cavity, and constricted with an India-rubber tube in the region of the cervix. The uterus was then cut off a few centimetres higher up. The stump was treated extraperitoneally, the constricting tube being fixed with needles, and Wells's clamp above these. A drainage tube was passed in at the lower end of the wound, and the pedicle and its cavity powdered with iodoform. All antiseptic precautions were used, except the spray. Patient recovered, and in March, 1885, was able to walk.

Case 2. The patient was also a Jewess, and had four children. The first two children were born at full time and without difficulty. The first child was suckled for six months, the second for more than a year and a half. In 1882 she had an abortion, and in 1883 twins, which, though small, were born with difficulty. The practitioner at that time recognized osteomalacia. Pain in the sacrum began in 1881. In 1884 she was unable to walk, and after that became smaller. In October, 1884, she became pregnant, and on the 9th of June, 1885, began to have pains. A medical man was not summoned till the 11th, and Kleinwächter saw her early on the 12th. The case was again one of osteomalacia, with miserable social surroundings. Height 148 cm.; in lumbar region, lordosis and left scoliosis. Pelvic measurements:

Between spines	25	centimetres.
Between crests	27.5	"
Between trochanters	28	"
External conjugate	19	"

Marked pendulous belly, and uterus size of eight months pregnancy; foetal heart gone and pains strong. Through the vagina, one could feel the skin of foetal head, separated from the bones, bulging down, but the pelvic bones could not be separated by force. The patient was in bad condition for operation; pulse 120.

Operation: The special points were, adhesion of omentum to peritoneum; uterus only the size of a man's head; no difficulty with intestines. Round the uterus, while in situ, an India-rubber tube was passed above the cervix and tightened. It could be felt that part of the foetus was thus grasped, owing to the projecting downward into the vagina of the foetal scalp. When the uterus was opened, gases escaped, and as the extraction of the foetus was difficult owing to its scalp being snared in the constricted lower uterine segment, the India-rubber tube had to be relaxed. The foetus was dead and putrid, and the head sausage-like, sixteen to eighteen centimetres long.

Kleinwächter was able to note the spontaneous expulsion of the placenta; it came as follows, the implantation being on the posterior uterine wall: The uterus lessened in bulk, and the placenta, apparently smaller, became elevated as well as thicker, the elevation being most marked at the centre. The edge was still adherent and no blood came. The placenta became still more elevated in its centre and was finally pushed out at the wound, foetal surface to the front. The edge then separated, blood escaped, and the placenta passed out foetal surface down. The India-rubber tube required to be adjusted higher, so that on the left side it was above, on the right side below, the ovary. The uterus (upper two-thirds) and left ovary were thus cut away, and the right ovary removed separately. The pedicle was, with difficulty, made extraperitoneal, and required to be sutured to the wound below the India-rubber band. Little blood was lost and the peritoneal toilette was carefully made. The patient recovered and her osteomalacia somewhat improved.

Kleinwächter points out that of the chief nationalities in Bukowina (Roumonians, Jews, Germans, and Poles) osteomalacia is almost exclusively found among the Jews. Although superior mentally to all but the Germans, they are yet poor, badly fed, and under bad hygienic conditions. The excessive time they suckle their children so as to prevent a new conception, is, in K.'s opinion, an important factor in determining osteomalacia. In both cases the

stump, after the portion above the ligature had sloughed off, passed back into the abdominal cavity. Kleinwächter points out the disadvantages of the extraperitoneal treatment of the pedicle, and considers the intraperitoneal treatment as the ideal to be aimed at.

[There is little to add to this valuable paper. The mechanism of the expulsion of the placenta is as Ahlfeld describes, but has no bearing on the natural process. Kleinwächter's second case recalls the one recorded by Sir James Simpson, where an elongated macerated fœtus was expelled spontaneously through a malacosteon pelvis. (Selected Works, edited by Black, p. 157.)]

PORRO'S OPERATION ON ACCOUNT OF CICATRICIAL NARROWING OF THE VAGINA.

WEISS reports (*Arch. für Gynäk.*, Bd. xxviii. Hft. 1) the case of a patient in a normal labor at her twentieth year. Three years after this she had a second child, the labor being as follows: Pains began on the evening of February 12, 1883, the head being in the second position. The membranes soon ruptured, and on the 11th, at 3 A.M., the os uteri was the size of two inches. Little progress was now made, and a medical man was therefore summoned, who applied instruments several times unsuccessfully. A second practitioner was asked to help, and perforation without extraction was performed. Ultimately, late on the 12th, the child was born spontaneously. Perineum was much torn, but not sutured, and parts were greatly swollen. The puerperium was marked by fever, and on the eighth day there were hemorrhage and passage of urine by the vagina. For five weeks this continued, but in about four months the patient could retain her urine, although no operation was had recourse to.

Weiss saw her about the end of her third pregnancy (April, 1884), and found her in bad condition, with severe pains in the back and feverish. The pelvis was simply flat; conjugata diagonalis, four and one-fifth inches (eleven cm.). The perineum was torn to the verge of the anus, but not into it, and was cicatrized, hard, and narrowed to a point about two cm. below the pelvic brim. So far as vaginal examination was concerned, pregnancy could not have been diagnosticated. Labor set in on May 14th, and on May 16th the opening at the top of the vagina was about two inches in diameter. Forceps were now applied, and ultimately a deeply asphyxiated child born, the cicatricial ring tearing in several places.

At her fourth labor the cicatricial condition of the vagina was more marked, and, therefore, the labor dragged on from October 25th till the 28th, when a rigor and threatening of uterine rupture came on. The cicatricial portion admitted merely the tip of the index-finger. Perforation and extraction were out of the question, and, therefore, Porro's operation was evidently best. It was performed in the usual way, an elastic tube being used for the pedicle, as well as silk ligatures for the broad ligaments. The patient recovered, and the child was also alive.

ON THE DEVELOPMENT OF MAMMARY FUNCTIONS BY THE SKIN OF LYING-IN WOMEN.

CHAMPNEYS relates (*Med.-Chir. Tr.*, vol. lxi.) a remarkable series of cases where, in puerperæ, the axillary sebaceous follicles seemed to take on mam-

mary functions. In the axillary skin, Champneys found small lumps varying in size from a pea to an egg, with a nipple or pore from which there could be squeezed granular débris, colostrum, and milk. He believes that the sebaceous follicles in lying-in women are capable of taking on mammary functions, and that this confirms the idea that the mamma is a specialized aggregation of specialized hair follicles. A table of thirty cases is appended, giving details as to dimension, secretion, etc.

THE INTRAUTERINE TRANSMISSIBILITY OF ERYSIPELAS.

LEBEDEFF notes (*Zeitschrift für Geb. und Gynäk.*, Bd. xii. Hft. 2) first the recorded cases of full time or premature children born with evidence of an intrauterine attack of erysipelas derived from the mother. Kaltenbach (*Cent. für Gynäk.*, 44, 884) recorded a case of a fully developed child, which, in the first few days after birth, had separation of the skin, first from the head, neck, and thorax, and afterward from the other parts of the body. This desquamation looked like that of erysipelas or scarlet fever, and was more probably the former, as the mother had twice an attack of bullous erysipelas of the lower extremities in the latest months of pregnancy, and had scaling of the skin at the full time. Kaltenbach believed this to be probably a case of conveyance of erysipelas from the mother to the foetus *in utero*, although, of course, no microscopic examination of the foetal skin and placenta, nor cultivation of the erysipelas micrococci, was made.

Runge, of Dorpat, published a similar case, which had occurred five years before in the Berlin Charité.

Lebedeff next records his own case, with an account of the microscopic examination of the skin of the foetus, discovery of the erysipelatous micrococci in the lymphatics, and a probable theory of their route from mother to foetus. His patient was admitted, in the seventh month of pregnancy, to the Obstetric Clinic, with the history of slight œdema of the lower extremities and an attack of erysipelas of the lower extremities. She was delivered of a premature, feebly developed child, which died in ten minutes. At first it looked as if the foetus were macerated, but this, of course, was highly improbable, considering its live birth. On inspection, the skin was divided into a great number of white and red patches, the former being somewhat raised, and the latter caused by capillary injection. The white patches were covered with vernix. The other organs seemed healthy, the liver being as large as one would expect from the development of the foetus.

To settle the nature of this foetal condition it was necessary to discover, and if possible cultivate, the pathogenic micrococcus described by Fehleisen. The latter was impossible, as the foetus had been dead for twenty-four hours when first seen by Lebedeff. He had, therefore, to settle the matter by examination of the skin. Small pieces of skin with both conditions (*viz.*, unaltered and supposed erysipelatous) were excised, hardened, and stained (celloidin process and Löffler's solution).

The following changes were found: In parts, the uppermost layers of the epidermis were wanting, as well as the rete Malpighii, so that the papillæ had no epidermal covering at all. The injected and dilated vessels were so superficial that they were covered merely with a thin layer of cellular tissue. The dermis was infiltrated with lymph cells, but this was not so marked in the

subjacent fatty tissue. The latter tissue contained the erysipelatous micrococci in its lymphatic spaces. No microorganisms were found in the blood-vessels, all this agreeing with Fehleisen's statement. No organisms were found in the placenta, but they were present in the umbilical cord near the amnion. Lebedeff believes that the route of the microorganisms from mother to fœtus was as follows: They were present in the lymphatics of the mother's legs and passed into the internal iliac plexus which anastomoses with the hypogastric lymphatic plexus. The lymphatics of the genitals open into the latter, and thus the micrococci may pass to the lymphatics of the uterus, and ultimately to the placenta. The difficulty of their being unable to pass through the epithelium of the villi Lebedeff gets over by supposing that they entered some of the villi which are not provided with such epithelium (Langhans). They thus reach the umbilical cord and the skin of the fœtus.

ON THE RELATIONS OF THE GONORRHOËAL INFECTION TO PUERPERAL DISEASES.

SÄNGER (*Arch. für Gyn.*, Bd. 28, S. 476) found in 1930 gynecological cases examined last year in public and private practice, 230 (12 per cent., or one-eighth of all cases) where the initial cause was gonorrhœa. This diagnosis was based on the existence of a catarrh of the vagina and uterus, with affection of the uterine annexa and connective tissue. In the history there were found either gonorrhœa in the husband, gonorrhœal affections of the children, diseases of the urinary organs, or affections of the Bartholinian glands. In 161 additional cases the diagnosis of gonorrhœa was certain in 22. Säger thus bases the diagnosis on clinical symptoms, as there is yet, he holds, no special characteristic of the gonococci, and they are wanting in tube affections.

The relations of gonorrhœal infection to pregnancy, labor, and the puerperium are of great importance. Some years ago Säger found in the Leipzig Clinique 100 cases of purulent discharge in 389 pregnancy cases, and 40 per cent. of the children with gonorrhœal ophthalmia, in spite of the use of injections. Gonorrhœa can cause symptoms in the puerperium like those of septic poisoning. The serious forms of gonorrhœal affections appear late in the puerperium, when the mischief has reached the tubes and peritoneum.

Two cases are given. In the first case (sixth labor) there were at the third week left parametritis and pelvic peritonitic exudations in Douglas's pouch, with high pulse and some rise of temperature. The husband had then a gonorrhœa, and the woman had, besides, the remains of an old gonorrhœal attack of the right uterine appendages. In the second case the patient was infected by her husband on the ninth day of the puerperium, and passed for twenty-two weeks through severe pelvic peritonitis.

Women, therefore, with recent or old inflammatory deposits, and with simultaneous affections of the appendages, have usually been infected with gonorrhœa.

MESIAL SECTION OF A WOMAN PREGNANT AT FULL TIME, THE CHILD PRESENTING BREECH; WITH REMARKS ON THE POSITION AND FORM-RELATIONS OF THE GRAVID UTERUS.

This atlas of WALDEYER (Berlin, 1886) fills a great gap in the anatomy of the full-time pregnant uterus, as, until now, obstetricians have never had a section of a cadaver with a full-term uterus, showing the relations of the cer-

vical canal. In addition, the foetus presented the breech, a presentation never hitherto figured from nature.

The cadaver was that of a multipara, thirty-eight years of age, who had already borne nine children. She was expecting her confinement daily when she was killed by a locomotive passing over the body at the junction of limbs and trunk. The cadaver was frozen by Waldeyer, sawn, and then hardened in alcohol. The first plate shows a sagittal mesial section of the entire cadaver; the second is the same, with the dorsum of the child drawn; in the third the left half of the internal surface of the uterus is given; while, in the fourth, the ventral surface of the foetus is figured. In plate five, transverse sections of a six months' pregnancy are drawn.

As the result of the accident there was a fracture of the pelvis in the neighborhood of the body of the first sacral vertebra; one of the arches of this vertebra, and one of the upper right pubic ramus, this last projecting into the lower segment of the uterus. The alterations which these conditions cause will be noted afterward. The cavity of the uterus is seen to be oval in shape, but slightly bulbous at its upper end. The placenta is at the fundus. The uterine wall is of almost uniform thickness. Veins are irregularly distributed in the walls, chiefly in the anterior walls and at the placental site.

The most important facts are in relation to the cervix. The anterior and posterior lips of the cervix are broad, and the anterior and posterior fornices vaginæ fairly marked. The cervical canal is intact, 38-39 millimetres (one and a half inches) long, and thus has the same length as the cervical canal of the two months' pregnant uterus figured by Braune in his large atlas. The views of obstetricians as to the behavior of the cervical canal during pregnancy have undergone many variations and contradictions since Matthews Duncan, Taylor, and others asserted that it remained intact until near the end of pregnancy; but this section supports their views in the strongest manner possible, and is a staggering fact for those, who, like Bandl, Küstner, and Bayer, hold that its upper end becomes absorbed into the uterine cavity prior to labor.

An entire microscopic section of the cervix, from os internum to vagina, is given, and the following facts brought out: The cervical glands are enlarged and pass out on the lips of the os uteri (probably from cervical laceration). In the upper third they are smaller and sparser. The epithelium of the canal is defective, probably from post-mortem changes. The upper two-thirds of the cervical canal contain mucus, and the membranes dip in no way into it. The form of the pregnant uterus is further well shown by transverse sections of a six months' pregnancy. The uterine shape is seen to be deformed by the intestinal coils, psoas muscle, and other anatomical structures. The fracture of the pelvis in the full-time breech pregnancy has disturbed the vaginal and urethral axis, and gives the pelvis a slight resemblance to spondylolisthesis. Apart from this, however, the atlas has the highest value to all obstetricians. In addition to its bearing on pregnancy, it has in its spinal, thoracic, and abdominal relations, many points of interest to the pure anatomist.

NOTE ON ONE OF THE CAUSES OF DIFFICULTY IN TURNING, WITH
REMARKS ON THE PRACTICE OF AMPUTATING THE PROCIDENT ARM.

Cases have from time to time been recorded in our weekly journals where a practitioner in an impacted cross birth succeeded in turning, only after

amputation of the prolapsed arm. These cases have been always difficult to understand, as the recognized and successful operation in such instances has been to decapitate with Braun's blunt hook.

DR. HERMAN'S paper (*Lond. Obst. Tr.*, vol. xxviii.) throws light on these, as he records three instances where he noted in impacted cross-birth that the shoulder of the prolapsed arm was caught beneath the contraction ring and thus prevented rising when version was attempted. Dr. Herman overcame the difficulty by pushing the shoulder toward the centre of the cervical canal and thus releasing the impaction hindering turning.

THE ALEXANDER OPERATION.

ZEISS considers (*Arch. für Gynäk.*, Bd. xxviii. Hft. 3), first, Winckel's objections to this operation as given in his recent "Lehrbuch." Winckel has pointed out that in retroflexion the utero-sacral ligaments are also relaxed, and also that by the operation one displacement was substituted for another.

Zeiss has operated thrice. In his first case the patient aborted at the fourth month, and a hernia had developed on one side. In Case II. the uterus was very movable at the region of the os internum. Operation easy, and result, so far, good. Case III. was a young girl who was unable to wear a pessary. Operation; pain diminished; now wears a ring pessary. Slavjansky had operated by way of trial. Two operations were good; in the third case he did not find the ligaments; in the fourth case operation was difficult, and in the fifth the result was good. Küstner had operated twice, with bad results. Mundé spoke favorably, and Winckel maintained his adverse opinion, alluding to the hernia in one of Zeiss's cases. Results were not yet at hand.

ON THE PREVENTION OF GONORRHOEAL OPHTHALMIA IN THE NEWBORN CHILD.

KALTENBACH believes (*Arch. für Gynäk.*, Bd. 28, Hft. 3) that the greater number of eye affections in lying-in institutions, as compared with private practice, is due to the more frequent vaginal examinations in the former, and in the carrying of the mischief from case to case during the puerperium. He employed vaginal injections of corrosive sublimate, 1 in 1000, and washing the eyes with distilled water. Great care was taken not to carry infection. In 200 cases so treated, he had one slight catarrh. This method avoids any irritation to the eyes, such as may arise from the use of nitrate of silver. In the discussion, Zweifel said he had tried vaginal douches of carbolic lotion and washing of the eyes of the child with boiled water as a preventive. This succeeded so long as carried out by the medical man, but without this he had an epidemic, and had to return to Credé's plan. Olshausen, Winckel, Leopold, Schatz, Prochownick supported Credé's method.

Credé gave his most recent results, viz., three slight cases in 1211 births. He pointed out that irritation of the eyes could be avoided by using a glass rod fifteen centimetres long, three millimetres thick, with smooth round ends, and thus a small drop obtained. He condemned drop bottles. His method could be carried out by midwives or the laity.

NINETEEN CASES OF AMPUTATION OF THE UTERUS FOR MYOMA.

GUSSEROW reports (*Charité Annalen*, 11th yearly issue) nineteen cases in which the uterus was removed by abdominal section at the level of the os internum, and thus the uterine cavity opened. Six of the patients died, a mortality of 31.6 per cent. Corrosive sublimate (1 in 1000) was the principal antiseptic, and carbolic spray was used in the room. The pedicle was usually treated intraperitoneally according to Schröder's method. In one case the extraperitoneal method was tried as the patient had prolapsus uteri, but death resulted. In two cases the bladder was opened into, in one owing to there being a diverticulum into which the male catheter used did not pass. He alludes to Keith's advice, viz., to have the bladder full. In the first case he sutured the wound, but in the second brought the wound into the abdominal incision, thus making an abdomino-vesical fistula. This ultimately closed; of course, a permanent catheter was employed through the urethra. For sutures to the stump and bladder he at first employed silk, but has now more confidence in sublimate catgut, owing to the silk ligatures usually coming away with or without pus. The indications for this operation he considers to be, bleeding, rapid increase, and pain. The removal of the appendage he considers to promise good results, but it is often difficult, and the results not yet sufficiently certain.

The following are some of the more interesting cases:

Case IV. Patient forty-three years of age. The tumor was rounded, projected three finger-breadths above the navel, dipped into the pelvis, and fluctuated at special points. Diagnosis, cystofibroma. The operation was difficult, and as it was impossible to turn the tumor out of the abdominal cavity, it was punctured to lessen its bulk. Blood issued from the punctures, and when the openings so made were stitched, the stitch apertures bled too. The tumor had adhesions to the omentum, bowel, and bladder. Ultimately the tumor was freed, a tube passed round at the top of the vagina, the stump sutured, and along with the edges of the bladder which had been wounded, fixed into the lower angle of the wound. The patient died in five days from septic peritonitis. On post-mortem there were general purulent peritonitis, total atrophy of the right kidney, and hydronephrosis of the left. Yellow atrophy of the heart, and œdema and hypostasis of both lungs were present. The tumor was in part telangiectatic.

Case XI. Patient forty-three years old. The abdomen was distended with a tumor reaching to the umbilicus, and evidently made up of three parts. One projected a hand's breadth above the symphysis, the second lay to the left, and the third to the right. The right tumor projected into Douglas's pouch, and the posterior vaginal wall was prolapsed. A large abdominal incision was made, and the tumor dipping into Douglas's pouch easily lifted out. The annexa, which were very vascular, were easily ligatured and separated, although the left spermatic plexus bled considerably. The vesico-uterine fold of peritoneum was then divided and separated from the anterior surface of the tumor with a good deal of hemorrhage. The tube was then passed round, the tumor removed, and the stump and peritoneum sutured. The patient died in twenty-seven days from septic peritonitis; there was no fever, but sickness, distention of the abdomen, pain, very rapid pulse, icterus.

Drainage was begun on the third day, and the abdominal cavity was washed out with tepid salicylic acid solution. On post-mortem, there were peritonitis, hemorrhagic ulcers in the jejunum, and double pyelonephritis.

PHYSIOLOGICAL AND THERAPEUTIC EFFECTS OF WATER AT DIFFERENT TEMPERATURES.

In this research (*Edin. Med. Journ.*, August and September, 1886), DR. MILNE MURRAY gives us exact researches on the action of water, at varying temperatures, on unstripped muscle. The variations in temperature were: Cold (32° – 60° F.), intermediate (60° – 100° F.), and hot (100° – 120° F.). The parts experimented on were the pregnant and non-pregnant uteri of rabbits, and a recording apparatus was employed by means of which the slightest contractions could be shown. The chief points made out were that, apart from any stimulus, there was evidence of constant rhythmic contractions going on in the uterus and vagina of the rabbit. This may go on for hours. The same was found to go on in the vagina of a pregnant primiparous woman. This was ascertained by passing a Barnes's bag into the vagina and connecting it with a manometer. The effect of a single application of water under 50° F. to the horn of the vagina was (a) a latent period of forty to ninety seconds; (b) a contraction taking one to five minutes to reach a maximum; (c) relaxation occupying three to fifteen minutes.

Single applications of water at 50° – 60° F. gave much the same results. *Successive applications of cold water rapidly exhausted the excitability of uterine muscle.* This is a most important fact.

The direct application of hot water (over 100° F.) gave as a result: (1) Abolition of latent period; (2) rapid maximal contraction; (3) slow relaxation.

The effect of repeated applications of hot water (110° – 115° F.) is to give a lengthening of the relaxation period—*i. e.*, we have almost a condition of tonus, then. The contrast between the effects of cold and hot water may be put thus: "While the initial efficiency of cold and hot water vary as 1 to 2, the efficiency of cold stimuli *diminishes*, in four experiments, from 6 to 1.4 (nearly to one-fifth); while the efficiency of hot stimuli, in the same number of experiments, *increases* from 12 to 48.5 (more than four times)."

The contrast between the two is well shown in the following columns:

Cold water (32° – 60° F.).

- (1) Marked latent period.
- (2) Slow contraction.
- (3) Relaxation thrice the duration of contraction.
- (4) Loss, in four experiments, four-fifths the initial efficiency.

Hot water (110° – 120° F.).

- (1) Latent period absent or very short.
- (2) Rapid contraction.
- (3) Relaxation twelve to twenty-four times the duration of contraction.
- (4) Gain, in four experiments, four times the initial efficiency.

In regard to the changes in the vessels, Dr. Murray found:

1. Water at 120° – 110° F. constricts bloodvessels and arrests hemorrhage from small arteries.

2. Water at 100° – 70° or 60° F., dilates small vessels and promotes hemorrhage.

3. Water at 50°–30° F. checks hemorrhage by constricting bloodvessels, but this only temporarily.

One interesting experiment was made on the pregnant uterus of a doe. The uterus was exposed, and a jet of water at 40° F. allowed to play on the one side, while one at 115° F. was directed on the other. This was continued for four minutes. The result was, at first, that both sides became pale; but at the end of the four minutes, the side receiving the hot water was anæmic, while vascularity was beginning on the other side. In four minutes, the cold side was bright red, the hot side still anæmic.

For therapeutics, therefore, hot water bears the palm. Its value in inflammatory conditions has now long been known, chiefly through Emmet's advocacy. Its value is very great in abortion cases. Dr. Murray mentions a case where the cervical canal was the size of a florin, and a hot vaginal douche caused the uterus to expel the entire ovum. For post-partum hemorrhage its rapidity of action and the tonus it induces make it the remedy in this accident. Dr. Murray recommends it, further, in gastric ulcer hemorrhage.

LABOR IN A PATIENT WITH DOUBLE SEXUAL AND URINARY ORGANS.

ENGEL (*Arch. für Gynäk.*, Bd. 29, Heft 1) first discusses the development of the genitals from Müller's ducts. It is fairly easy to understand the double sexual organs in this case, but the double condition of the urinary organs is puzzling. The woman had also a cleft pelvis (*Spaltbecken*). The case is described as follows:

A. L., thirty years of age, admitted to hospital April 6, 1885. The nurse's attention was directed to the abnormal condition of the sexual organs, and a careful examination of the case made by Engel. On separation of the limbs a tumor, about the size of a hen's egg, between the labia majora, uncovered by hair, could be seen. Between its lower end and the anus there was mucous membrane, and on each side a vaginal entrance, bounded laterally by the labia majora. The clitoris, with its prepuce, was double; labia minora were present, as well as a double urethral orifice. The right hymen was ruptured but the left was intact. The rectum was dilated so as to admit two fingers. The right vagina was wide; os uteri dilated to the amount of two finger-breadths; membranes intact, and presenting part high. On external examination the child was found to be breech, and the symphysis joint was deficient, the ends of the bone about two centimetres apart, and the space filled up by soft parts (*Symphysenspalte*.) Ultimately the child was extracted manually and lived. The first stage lasted twenty-nine and a half hours, the second eight hours, the third eighteen minutes.

The unimpregnated uterus was felt, after labor, in the true pelvis and about the size of a two months' pregnancy. By the catheter 120 grammes of urine were removed through the right urethra and 100 grammes through the left. The patient urinated spontaneously through the right urethra, but required the catheter for the left bladder. [One would have expected the reverse of this, as the right uterus was the pregnant one.] It was specially noted that during the labor no further increase of the cleft happened. Thus in this remarkable case of a deficient pubic symphysis and double genital urinary organs, the labor ended normally.

It is also surprising that the patient suffered no inconvenience in walking. Repeated after-examinations of this case showed that the uteri were separate from one another, and that the bladder and urethræ did not communicate. There were only two ovaries. The condition of the genital organs can be partially explained, but not that of the urinary organs. So far as is known, the allantois, from which the bladder develops, is a single organ.

MEDICAL JURISPRUDENCE AND TOXICOLOGY.

UNDER THE CHARGE OF

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SIGNS OF VIRGINITY IN AN EXHUMED BODY.

GRIGORESCO, of Ilfov (*Annales d'hygiène publique*, Sér. 3, T. xvi. 1886, pp. 225-239), gives the results of the medico-legal investigation of a case where it was important to determine if a child, aged seven years, and buried for one year, had been violated previous to death. The occasion of the investigation was the death of the child's father from poisoning by sulphide of arsenic (orpiment). His wife, who was suspected of having administered the poison, alleged, on the contrary, that he had committed suicide from remorse at having violated his young daughter a year before her death. The body of the daughter was accordingly exhumed. It was found to contain a large quantity of sulphide of arsenic, so that there was no doubt as to the child also having been poisoned. The mother had stated that her knowledge of the defloration of her daughter was obtained from the confession of the child, and, later, of her husband. She admitted, however, that, although she noticed some spots of blood on the chemise of the child, she did not examine her person; further, the child had not complained of any soreness about the genitals. The medical examination of the exhumed body showed that all the fleshy parts of the body were completely mummified. The lower part of the trunk, containing the genital organs, was macerated for seven hours in a three per cent. solution of potash, when it was transferred to pure water and kept there for two days. By this time, the soft parts were much softened, and began to assume the appearance of a freshly buried corpse. The vulvo-vaginal orifice was now easily recognizable. The parts were next digested for a day or two in a weak solution of acetic acid. All the parts had now become as soft as those of a corpse dead for twenty-four hours. The labia majora and minora were perfect. The anterior commissure of the latter was well preserved, as was also the prepuce of the clitoris. The vestibule of the vulva was preserved in all its integrity, and the urethral opening was easily made out. Below the latter was the vaginal tubercle, of the size of a lentil, and having attached two grayish membranous shreds, three mm. long and two mm. broad, which lost themselves in the circumference of the vaginal orifice. The muscular covering of the vagina

and rectum was completely preserved. On the left labio-vaginal surface, toward the posterior commissure, there was a fragment of grayish membrane, half a mm. in thickness, four mm. broad, and five mm. long. It was attached along one of its borders. The free border was irregular. This membrane appeared to be a portion of the hymen, the remainder of which had been destroyed by putrefaction. The pelvis was now placed in alcohol for three days and again examined. The examination was aided by slight dissection. There was now discovered, near the membrane just described, another finer membrane, three mm. broad, of a ribbon-like form. It passed toward the vaginal tubercle, and was six to seven mm. long. One end was attached to the vulvo-vaginal surface, the other was free. It formed about the half of a crescent, whose concavity looked toward the front of the vulva, and was undoubtedly the left half of the hymen. The membranes were further hardened in alcohol, and examined microscopically. They were found to agree in structure with the hymen. From this investigation it was concluded that the child had not been deflowered a year previous to her death, otherwise there would have been no remains of a membranous hymen; and it was highly improbable that she had been deflowered shortly before death (when membranous fragments of the hymen might have remained), for the reason that defloration must have been accompanied by great injury to the vulva and by copious hemorrhage, and by complaints of great pain, of which the mother gave no evidence. The mother was convicted of a double homicide, and sentenced to penal servitude for life. Four years afterward she confessed that she was guilty of the double crime, and that she had invented the story of her daughter's violation.

CURARA.

S. POLLITZER, of New York, has, under Kühne, of Heidelberg, reinvestigated some points in the action of curara (*Journal of Physiology*, vol. vii. pp. 274-282, 1886). Many years ago Kühne found that the irritability of the sartorius muscle of a frog, poisoned with even the largest doses of curara, was never wholly uniform throughout the length of the muscle, the median portions supplied with nerves having a greater irritability than the nerveless extremities. He concluded, therefore, that curara leaves unaffected certain terminal nerve-elements in the muscle. Sachs was unable to verify Kühne's results, and attributed them to imperfect curarization of the muscle. Pollitzer has repeated Kühne's experiments with the aid of a carefully devised apparatus for applying electrical stimulation to the muscle at different points in its length. He first of all ascertained what variations in irritability exist throughout the length of the normal sartorius of a frog. He found certain variations common to all normal sartorii. These variations he attributes to differences in nerve distribution. He then investigated the effect of curara, and found that, although curara diminishes the irritability of the muscle in its whole length, yet it does not greatly affect the variations observed in the normal muscle. That is to say, certain portions of the muscle still remain more irritable than other parts. If the nerve terminations in the muscles were perfectly and wholly paralyzed by curara, as is usually maintained, then it was to be expected that the linear variations in the irritability of the muscle

would have disappeared, since these were dependent on the nervous supply, and the nervous supply was now eliminated. Reasoning in this manner, Pollitzer concludes that "curara leaves unaffected certain terminal nerve-elements in the muscle," and that "it affects some part of the nerve-fibres between the nerve-stems and their ultimate ends in the muscle fibrillæ." He suggests, although he is able to offer no proof of this, that the particular part affected by the drug is the cement substance at the nodes of Ranvier, which becomes so modified that the nervous impulse can no longer pass through it. The paper is one of considerable interest.

CACODYLIC ACID.

J. MARSHALL and W. D. GREEN (*Amer. Chem. Journ.*, vol. viii. 128-138, reported in *Journ. Chem. Soc.*, cclxxxv. p. 730, 1886) have reinvestigated the action of cacodylic acid. Several investigators have stated that the acid, in spite of its containing the element arsenic, has no poisonous properties. Lebahn, however, observed that rabbits died in from one to twenty-five days after injection of quantities of cacodylic acid up to 2.3 grammes. As Lebahn makes no mention of the purity of the acid he employed, it is probable that the results he obtained were due to an admixture of ordinary arsenious acid in the preparation used. Marshall and Green find that commercial cacodylic acid often contains arsenious acid. These investigators administered pure cacodylic acid to dogs in doses of one to three grammes without producing a lethal effect; salivation, vomiting, and purging were the only symptoms observed. Larger doses did not cause death unless in the case of one small dog, which died after the subcutaneous injection of three grammes. The authors believe that the general effects of cacodylic acid are similar to those of arsenious acid, but are more transitory.

THE POISONOUS ACTION OF PEPTONES AND ALBUMINOSES.

S. POLLITZER has, in Kühne's laboratory, investigated the action of peptones and albuminose on animals (*Journal of Physiology*, vol. vi. pp. 283-290, 1886). The albuminose were prepared by the method of Kühne and Chittenden, and the peptones by that of Wenz. Similar experiments had formerly been made by Schmidt-Mülheim and others, but the preparations employed were impure. The results of Pollitzer's experiments are the following: All the varieties of albuminose and peptones employed, except anti-peptones, exercise a strong narcotic action on dogs and cats when introduced into the veins, hetero-albuminose being the most powerful of them. In addition to the narcosis which supervenes within two minutes—and is said to resemble that produced by chloroform, although the reflexes are perfectly preserved—there are at first signs of strong intestinal peristaltic action, accompanied by defecation, and generally also by micturition. There is no motor paralysis; but the muscles are thrown into a cataleptic condition. The author denies that the poisonous effects are due to the admixture of a ptomaine, as Brieger has asserted. Most of the substances employed have a remarkable effect in preventing or delaying the coagulation of the blood drawn from the arteries of an animal into whose circulation an injection has been made. They also have a marked effect on the blood-pressure, greatly lowering it.

This is due to the vaso-motor paralysis. The narcosis is coexistent with the lowering of the blood-pressure. The albuminoses are sharply distinguished from the peptones by the fact that a sufficiently large dose of the former (more than 0.3 grm. per kilogram.) is inevitably fatal, whereas peptones never produce this result so long as the kidneys are intact. The peptones are rapidly excreted.

THE NATURE AND ACTION OF THE VENOM OF POISONOUS SNAKES.

R. NORRIS WOLFENDEN has undertaken, in the physiological laboratory of University College, London, an investigation of the nature and action of the venom of poisonous snakes, the results of the first part of which have been recently published in the *Journal of Physiology*, vol. vii. 327-364. So far he has investigated the venom of the Indian cobra (*naja tripudians*) and of the Indian viper (*daboia russellii*). As to the nature of the poison of the cobra, the author concludes, from a number of careful experiments, and after a critical examination of the investigations of previous observers, that "the toxic power of cobra venom resides in the proteid constituents of the secretion, and is lost when the proteids are removed and diminished as these are diminished." It is not of the nature of a germ, nor is it alkaloidal. Blyth's cobric acid, he believes, has no real existence. An attempt was made to separate and distinguish the proteid constituents of the venom; and globulin, serum albumen, and syntonin were obtained, with an occasional trace of peptone. The supposed action of permanganate of potash as an antidote to cobra poisoning is due merely to its usual action on the proteids, which it oxidizes and destroys. This, however, it cannot effect after the poison has been absorbed. A few experiments were made on rats, in order to observe the action of the cobra venom and of some of its constituents. The usual symptoms were observed: drowsiness, with progressive paralysis of the muscles of locomotion, followed by paralysis of the larynx and tongue, salivation and vomiting, increased secretions, slow and labored respirations, convulsions and asphyxiation, the heart continuing to beat long after apparent death. Consciousness remained to the end.

The examination of the venom of the Indian viper was not so complete, but enough was done to lead to the conclusion that its toxic properties are resident in its proteid constituents. As in the case of the cobra venom, the author was able to separate various proteids. These were similar in chemical character to those obtained from cobra venom, except that albuminose took the place of syntonin. The author believes that the investigations of Pollitzer (a summary of which will be found above), and others, of the action of ordinary peptones and albuminoses, point to the probability of the proteid constituents of the venom being likewise the poisonous constituents.

COBRIC ACID.

In 1876, Wynter Blyth published, in *The Analyst*, an account of an acid (cobric acid) which he had separated in small quantity, and in crystalline form, from the cobra venom, and which he believed to be the poisonous constituent of the venom. WOLFENDEN (*Journal of Physiology*, 1886, vol. vii. pp. 365-370) has repeated, apparently with great care, the process by which

Blyth obtained the acid, but with entirely negative results. He finds, however, that the crystals described and figured by Blyth bear a striking resemblance to those of sulphate of lime. For this and other reasons, he concludes that the crystals of so-called cobric acid are really sulphate of lime.

ERGOT.

It is rare that, in cases of ergot poisoning coming under the cognizance of criminal authorities, the chief symptoms take the form of gangrene. Such a case was recently reported to the Société de Médecine Légale de France, by M. POUCHET (*Annales d'hyg. publ.*, sér. 3. xvi. pp. 253-270, 1886). It was that of a young woman, a domestic servant, who, after having aborted on several occasions, died suffering from gangrene of the extremities, the gangrene having appeared about a month before death. There was strong suspicion of her death having been caused by ergot; and on investigation it was found that, while in the employment of a farmer, she had become pregnant on several occasions. On the first three of these, her master had administered to her an inodorous, bitter, grayish-white liquid, which soon caused violent colic and pain in the loins with a feeling of extreme lassitude, followed a few days afterward by menorrhagia and abortion. On the fourth and fifth occasion she stoutly refused to take the draught which was prepared for her, and her pregnancies terminated naturally in the birth of two children. On two subsequent occasions she was again pregnant, but consented to take the draught, which was several times repeated, and, as a result, she aborted. Finally, on the 6th of March, 1885, she had still another abortion, brought about as before by taking the mixture prepared by her master. A month afterward she was visited by a doctor, and found to be pale, cyanotic, and œdematous; tongue furred; breath fetid; pulse feeble and irregular; great dyspnoea with mucous non-sanguinolent expectoration; dulness and crepitations at the apex of the right lung; considerable hypertrophy of the heart, with bruit accompanying the first sound. The doctor ascribed these symptoms to the condition of the heart. Three months later, about the middle of July, and a month before her death, gangrene appeared in both hands, the right forearm, and both feet. There was now a condition of extreme cachexia. At her death (August 14th) the gangrene had advanced considerably. After the autopsy an analysis was made of several parts of the body (uterus, stomach, liver, kidneys, heart, brain, etc.) in order to ascertain whether ergot was discoverable. By means of petroleum ether a coloring matter was separated which presented a spectrum absolutely identical with that of ergot, and an extract was prepared which, M. Pouchet says, exhibited all the reactions of ergotinine. A dog poisoned with ergot, and afterward examined, yielded chemical results similar to those met with in the case of the woman. Pouchet, therefore, concluded that the woman had died of ergot poisoning, and that the ergot had been administered over a great length of time, probably several years, though intermittently, as the history of the case showed. Her master was condemned to ten years' imprisonment.

ACTION OF LIME, POTASSIUM, AND OTHER SALTS ON MUSCULAR TISSUE.

PROF. SYDNEY RINGER, of London, gives the results of further investigation of this subject (*Journal of Physiology*, 1886, vol. vii. pp. 291-908). In

experiments on the heart, he states that he now employs phosphate of lime, instead of chloride of calcium, in the composition of the artificial circulating fluid. With such a fluid the contractility of the frog's heart can be preserved for several hours. It also preserves the contractility of skeletal muscles for a long time. It preserves contractility fully one and a half times as long as the usual 0.6 per cent. saline solution. The addition of bicarbonate of soda to the ordinary saline solution increases its power; but it is still less effective than phosphate of lime. The addition of chloride of potassium to the saline solution containing phosphate of lime still further increases its power of preserving muscular contractility. From such results as these, the author argues "that lime and potash salts are as necessary to the metabolism of muscle at rest as to the metabolism occurring during a muscular contraction." He also gives experiments to show that salts in part preserve contractility by preventing or lessening twitching of the muscles.

HYPOCHLORITE AND HYPOSULPHITE OF CALCIUM.

PROF. POINCARÉ, of Nancy (*Annal. d'hyg. publ.*, sér. 3, tome xvi. pp. 153-155, 1886), states, as the result of several experiments on some of the lower mammals, that the gases which escape from dry hypochlorite of calcium or from hyposulphite of calcium have no bad effects on animals. The experiments were made by keeping the animals, for more than a month, in cages containing saucerfuls of the substances. A little acid was from time to time added to the hyposulphite.

PUBLIC HEALTH.

UNDER THE CHARGE OF

SHIRLEY F. MURPHY, M.R.C.S.,

LECTURER ON HYGIENE AND PUBLIC HEALTH, ST. MARY'S HOSPITAL, LONDON.

MILK INFECTION.

In the last number an account was given of a disease occurring in cows on a farm at Hendon, Middlesex, which was believed to have given origin to infection with scarlet fever of the drinkers of milk from these cows. The official report by MR. W. H. POWER, Medical Inspector of the Local Government Board of England, is now published, and the evidence which he adduces therein may be held to be sufficient to warrant the conclusion that the cow-disease caused scarlet fever in man. The farm, which consisted of three sheds—a "large," "middle," and "small" shed, beside quarantine sheds—was found to have had special pains taken to render it, as the phrase is, "sanitarily perfect," and had for several years been the subject of special supervision by the Medical Officer of Health of the district, who had also undertaken to observe and report to the London milk retailers any occurrences of infectious disease in the neighborhood of the farm. Milk from the

farm was distributed in four different districts of London and in the district of Hendon, Middlesex, and it was early ascertained that if the milk had caused scarlet fever amongst its consumers, it had not acquired the ability to do so in any commonly accepted way, such as through unwholesome conditions of water or drainage, or through careless handling of milk or milk utensils by persons carrying scarlet fever infection. Nor during the long subsequent acquaintance with the farm gained in the course of this inquiry did any reason appear for modifying this conclusion. Inquiry elicited the following facts: Scarlet fever attacked the consumers in two London districts—South Marylebone and Hampstead—at the end of November, or the early part of December of 1885, the latter district being again attacked in mid-December; a third London district—St. Pancras—was attacked early in December and mid-December; the consumers in the fourth London district—St. John's Wood—escaped up to the date of the inquiry; while the Hendon consumers were attacked in early December.

London district, South Marylebone, received all the milk from the large shed, and when this was insufficient it was made up with the milk from the middle shed, which also supplied districts Hampstead and St. Pancras, and when the supply was insufficient was supplemented with milk from the small shed; the rest of the milk from the last shed went to district St. John's Wood. The milk from cows in the quarantine shed was distributed to the first three London districts.

Three newly calved cows were received from Derbyshire on November 15, and after being in the quarantine shed for a few days, were transferred to the general sheds. Four other cows from Oxfordshire followed them on December 4, first into the quarantine shed, and then transferred to the general sheds. It was seen that the arrival from Derbyshire of the newly calved cows did, in fact, shortly precede the first occurrence of scarlatina in four milk districts, namely, at the end of November or beginning of December; so that the cause of the scarlatina (whatever it was) was actually manifested in these four districts just after the time when the milk of these cows came to be included in the produce of the farm.

The date of the appearance of scarlatina in the different districts coincided with the subsequent distribution of the newly arrived cows. Thus, the 15th of November cows had been toward the end of that month transferred to the "large" shed, and their milk had been delivered from thence. The four 4th of December cows had been transferred about December 11—two of them into the "large" shed and two into the "middle" shed. As already stated, scarlatina began at the same time to appear among consumers of milk from these sheds, and during this time the drinkers of milk from the other sheds remained exempt. Later it was ascertained that the November 15 and December 4 cows were the first to be attacked with the vesicular disease previously described, and scarlatina continued among the drinkers of their milk throughout. But it was observed that there was temporary diminution, if not a cessation, of fresh attacks among the drinkers of milk from the "middle" shed about Christmas, and this corresponded with the removal of two of the December 4 cows from the middle shed to the large shed. Later, scarlatina appeared among these persons, this fact corresponding in point of time with the appearance of the vesicular disease among the other cows of the middle shed

doubtless contracted from the two December 4 cows which had been transferred. Finally, at the close of the inquiry the drinkers of milk at St. John's Wood, who received their milk from the small shed, began to be attacked, and then it was found that the cow disease had extended to the animals in that shed. Other evidence was forthcoming which need not here be stated, but it tended to confirm the conclusions at which Mr. Power had arrived.

The further investigation of the relations between the cow and human malady then passed into the hands of DR. KLEIN, who took for experimental purposes samples of milk, contents of vesicles, and discharges from ulcers of two affected cows, and afterward two other affected cows were purchased and conveyed to him at the Brown Institution, in London. The following is a brief outline of his work. Dr. Klein inoculated several calves with the matter taken from the sores of an affected cow; with a general result that, after an incubation of about three days, the places of inoculation became swollen, tender, and spreading; on the fifth or sixth day the change was distinct, the successful places having become sores, the marginal part showing vesiculation, and in the centre formation of crusts. In slight cases the healing began about the ninth or tenth day, in severe cases not before the end of the second week. Microscopic examination revealed a number of red blood-disks mixed with a large number of pus-cells, each of which contained two, three, or four small nuclei and remnants of epithelial cells. Among the pus-cells numerous dumb-bells of micrococci (or diplococci), and a few short chains of the same were met with; in size these microörganisms did not differ from those described in connection with foot and mouth disease. From the deeper parts of an ulcer material was obtained with which tubes containing either solid nutritive gelatine or agar-agar mixture were inoculated; after some days, and in both media, a micrococcus appeared, the growth of which was extremely characteristic. The general aspect of the growth is very similar to that presented by the streptococcus of foot and mouth disease, but the latter, when grown in milk, does not affect the fluid character of the milk, whereas milk inoculated with the organism obtained from the cow's ulcer will, if kept for two days in the incubator, at 35° C., have been turned completely solid.

To learn whether the milk, while in the udder, contained the streptococci, one teat, free from any ulcer, but of a cow having several ulcers on other teats, was milked, and from this milk a large number of gelatine and agar-agar tubes were inoculated. A second teat of the same cow, affected by an extensive ulcer, was milked to the same extent, and from the milk thus obtained a large number of other gelatine and agar-agar tubes were inoculated. In the first series no single tube showed the growth of the streptococcus; whereas, in the second series, one gelatine tube and one agar-agar tube were found to develop the streptococcus. With a cultivation (a third subculture) two calves were inoculated on February 1st; on February 27th one calf was dead. There was effusion at and around the seat of inoculation, and the neighboring glands were swollen and red; there were peritonitis with sanguineous exudation, congestion, and hemorrhagic spots in omentum and serous coat of stomach; the spleen appeared small; the liver greatly congested; the kidneys very large and much congested; the ileum much congested, and its mucous membrane and the epithelium detached in flakes, the mesenteric glands belonging to the ileum enlarged and hyperæmic; both lungs congested, bronchial glands

enlarged and congested; organs of throat congested; and there was pericarditis. The other calf showed, on March 7th, around the nostrils, lips, and on hard palate and gums, numerous irregularly outlined, brownish patches. This animal was killed on March 8th, and the post-mortem appearances much resembled those found in the calf previously examined.

Dr. Klein notes that the changes in the kidneys are highly interesting, since they completely coincide with those in acute scarlatinal nephritis in man. Cultivations were made with blood taken from the heart, and a growth of the streptococcus was obtained, in all respects identical with the streptococcus that had been employed for inoculation of the animals. Dr. Klein says, in conclusion, that he considers it completely established that this streptococcus is identical with the virus of the cow disease.

DISPOSAL OF REFUSE.

The solution of the difficult problem of disposing of the excremental refuse of communities is being attempted in different ways. In London, where the water-carriage system is carried out, an effort is being made to precipitate the sewage by chemical means, and to discharge the effluent into the river, contrary to the advice of the recent Royal Commission on Metropolitan Sewage Disposal. Some portion of the solid matters is to be precipitated with sulphate of iron and lime; after settling for an hour or two, the effluent is to be thrown into the river, but it is expected that in hot weather something more will be necessary to insure complete immunity from offensive effluvia arising from secondary fermentation, and it is, therefore, decided to treat the effluent with permanganic acid (a mixture of manganate of soda and sulphuric acid) before sending it into the river. The sludge, it is anticipated, cannot be disposed of in the vicinity of the outfalls; it is, therefore, proposed to provide steamers of suitable construction to carry it out to sea.

MR. CONDER has proposed to the town of Guildford that the sewage should be treated with certain purifying agents, of which a principal one is sulphate of iron. He suggests that a wire-work cage containing this material should be placed in the sewer and immersed to the extent of about an inch and a half in the sewage, the sulphate being thus dissolved in the sewage (*Lancet*, Sept. 4, 1886). Another mode has been proposed by DR. LOWNDES, of H. M. Indian Medical Service, in a pamphlet entitled "Antiseptic Drainage and the Utilization of the Whole of the Products of Excreta." He objects to cess-pools, river carriage, and sewage farms, and proposes to separate solid excreta, urine, and domestic slop waters: the solids being mixed with charcoal and used as manure; the liquids being stored in tanks in which the surface of the fluid is kept covered with a layer of oil and some antiseptic, and these tanks emptied every month and conveyed to central stations. The kitchen slops, he suggests, should be subjected to a process by which the water would flow into the sewers with the rain-water, but the scum of grease would remain in a species of trap, which would be emptied only at intervals. *The Lancet* states that probably this system would be found impracticable in tenement houses, where the want of space for the tanks and the ignorance of the inhabitants would entirely prevent the scheme being carried out; besides this, the retention of solid and liquid excreta in the midst of a populous town would be most prejudicial to the health of the people.

A Belgian Commission, appointed to decide upon the question of disposal of excrement in towns where sewers are impossible, decided as follows: The use of cesspits is inadmissible. The separation system is useless. That of disinfection is costly, and often destroys matter which might be utilized. The process of deodorization is not applicable to all places; in hospitals, barracks, or camps it would give good results, but not everywhere. Fixed and movable receptacles are admissible for want of anything better; the arrangements for emptying them, however, should be in the hands of the local authority. But the disposal of waste water is difficult to manage with cess-pools, and, therefore, the best system would be that which would consist in carrying away by means of pumps all excremental matter, and depositing it, according to its value, in one or more central reservoirs. The systems of Bertier and Liernur approach most nearly to this ideal, and it is probable that before long science and experience will find some means of solving this difficulty (*Journal d'Hygiène*, vol. xi. No. 521, p. 466).

Sewage farms have, in some localities, found great favor. It is true the inhabitants of Norwood, near London, have complained that the neighborhood was being rendered unhealthy by the sewage farm; but at Nottingham they have lately selected sewage farming as the safest means of disposing of their refuse, and a paper on this subject was read by Mr. TARBOTTON, engineer to the Corporation of Nottingham, at the meeting of the Municipal and Sanitary Engineers' Association, in July. Mr. Tarbotton arranged that all the valley sewage should be sent by gravitation from the borough to a tract of land secured by the Corporation, about five miles outside the town. There is to be accommodation for about a hundred cows, for forty horses, and for pigs, which consume much of the vegetables produced on the farm. The only objection to the scheme seems to be that there is no prospect of the sewage yielding an income sufficient to repay the large outlay made in the beginning, but that seems to be the case everywhere. An account is given (*Vierteljahrsschrift öff. Gesundheitspf.*, Bd. 18, No. 2, S. 255) of the sewage farms round Berlin; there the amount received from the sale of the products falls far short of the expenses. The chemical examination of the effluent was made by Dr. Salkowski, and that from the meadows appeared to be always clear, colorless, and without odor; the water draining beds being also of the same character, except that now and then a faint earthy smell was perceptible. As regards the health of the inhabitants in the neighborhood of these farms, it appeared to be excellent, the mortality per thousand not reaching to half as high as in Berlin itself. Out of fifteen children who died, but one suffered from an infectious disease; while none of the adult population were attacked by any disease which could be in any way attributed to the sewage farm.

TYROTOXICON: ITS PRESENCE IN POISONOUS ICE-CREAM, ITS DEVELOPMENT IN MILK.

DR. VICTOR C. VAUGHAN, Professor of Physiological Chemistry at Michigan University, referring to his discovery in cheese of a highly poisonous ptomaine, relates in *The Practitioner* (September, 1886) further discoveries of the same ptomaine in milk which has been kept. Last November he succeeded in isolating this poison from milk which had been kept in bottles

tightly closed with glass stoppers for three months. The method of testing for the ptomaine was as follows:

The coagulated milk was filtered through filter paper, the filtrate was found to be acid, and was then rendered slightly alkaline by the addition of potassium hydrate, and agitated with ether. After separation the ethereal layer was removed, allowed to run through filter paper to remove a flocculent white substance which floated in it, and then allowed to evaporate. If necessary, the residue was then dissolved in water, and again extracted with ether. The tyrotoxicon was recognized by its crystalline appearance, by its odor, and by placing a bit on the tongue. Ten drops of a concentrated aqueous solution of the poison were given to a young dog, which retched, vomited a frothy fluid, suffered from muscular spasm over the abdomen, and passed watery stools. The next day it seemed to have recovered, but could not retain food for several days.

In June, of this year, Dr. Vaughan examined some ice-cream which had affected eighteen persons. He found that the vanilla used for flavoring did not contain the poison, and then commenced to test the cream itself. The aqueous solution was then given to a young cat, which suffered in a manner similar to the dog. Dr. Vaughan received information from the doctor in attendance on the persons who were attacked, that their symptoms resembled those of the dog and cat; vomiting commenced about two hours after eating the cream, followed by purging, severe occipital headache, and pains all over the body, especially in the extremities. The throats of all were cedematous, one or two were stupefied, and some lost consciousness for a moment or two. An interesting point in connection with this outbreak was that some of the same cream as that which poisoned these persons was used to make lemon cream, but this produced no untoward symptom. It was subsequently ascertained that the lemon cream was frozen first, and Dr. Vaughan considers that this early freezing prevented fermentation, which proceeded in the vanilla cream, giving origin to the poison. Concerning the chemical composition of this ptomaine, Dr. Vaughan points out that he always found more or less butyric acid in the cheese, milk, and cream in which he found the poison, and he thinks that it may be there is some intimate relation between butyric acid fermentation and the production of the poison. He refers to Selmi's discovery of a ptomaine which resembles coniine, which can be formed by the action of a ptomaine on ammonia. Tyrotoxicon is not known to resemble coniine, but other fatty acids may react with decomposing nitrogenous substances, forming alkaloids.

MUSHROOM POISONING.

DR. HANDFORD, physician to the Nottingham Hospital, gives an account (*Sanitary Record*, September, 1886) of poisoning by mushrooms. After referring to the close resemblance of edible to poisonous fungi, and specially noting that agaricus (amanita) muscarius, which is virulently poisonous, can with difficulty be distinguished from agaricus (amanita) rubescens, he gives the history of a case of poisoning from eating agaricus (amanita) phalloides. A man gathered some of this fungus and ate it in the evening, giving part of one to his child, the next morning he experienced a sense of constriction at the chest, but went to his work as usual. While there, he was seized with

vomiting, purging, and profuse sweating; he was admitted into the hospital, and the following morning Dr. Handford saw him. He still continued vomiting and purging; he had severe pain in the abdomen; the sweating had ceased, and the pupils were normal; he had suppression of urine, the heart's action was regular, but feeble, and the pulse could scarcely be felt. He was given small doses of atropine subcutaneously, but the benefit was slight, and the man died sixty-eight hours after eating the mushrooms. The death was due, it was gathered from post-mortem appearance, to the action of muscarin on the heart and vascular system. The child died twenty-nine hours after eating a portion of *one* mushroom; she suffered chiefly from vomiting and depression. The man had drunk no water, and this probably accounted for the late onset of the disease, the muscarin being only gradually formed as the fluids of the stomach penetrated the mushrooms. In conclusion, Dr. Handford observes that the antagonism of atropine to muscarine does not appear to be sufficiently accurately determined to enable the one to be given with much success as an antidote to the other.

INDUSTRIAL DISEASES.

Amongst the numerous trades that are injurious to health may be mentioned the manufacture of needles and pins. M. LÉON POINCARÈ, of Nancy, has stated in his *Traité d'hygiène Industrielle*, and to which reference is made in the *Journal d'Hygiène*, vol. xi. No. 518, p. 362, that the most injurious part of the manufacture consists in the "pointing," which must be done when dry, to prevent rust. This operation produces so fine a dust that the workmen engaged in this duty die of pneumonia or phthisis at the end of ten or fifteen years; and he recommends the use of machines in which the grindstones would be replaced by steel drums scratched on the surface and under which could be introduced a flat surface of steel with the needles. Thorough ventilation is also recommended and constant variation of work.

Another disease, which proved to be very fatal, occurred in a paper manufactory, at Ligat, in the Baltic Provinces. In the rag-sorting room, 56 women were employed in April, 1886: 12 cases occurred, 5 proved fatal, one of them within twenty-four hours from the commencement of the attack. The symptoms were similar in all the cases; the disease began with a rigor, in some cases the temperature rising rapidly, but not in others, great depression and headache followed, and all with frequency of respiration, cough, thready pulse, and then a fall of temperature. There was no delirium, but the person attacked sank, collapsed, generally in less than three days. Rapid decomposition set in, commencing on the chest and neck, the bronchial glands were much swollen, sanguineous serum was found in large quantities in the pleural cavities and pericardium. A committee, consisting of Drs. SCHULTZ, HEERWAGEN, and KRANHALS, investigated the outbreak and came to the conclusion that it was "rag-sorter's" disease, and they secured portions of the bodies and specimens of the serous fluids for further research. Bacilli were found, some of them resembling Koch's "malignant oedema bacilli," and a small dog into which some fluid was injected died on the third day with symptoms of malignant oedema.

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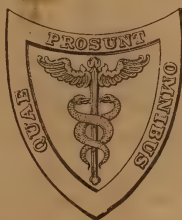
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Annales de Dermatologie et de Syphiligraphie.	Provincial Medical Journal.
Annales de Gynécologie.	Practitioner.
Annales des Maladies des Organes Génito-Uriinaires.	Australian Medical Journal.
Archives de Médecine et de Pharmacie Militaires.	Indian Medical Gazette.
Archives de Neurologie.	Bibliothek für Læger.
Archives de Tocologie.	Nordiskt Medicinskt Arkiv.
Archives Générales de Médecine.	Upsala Läkareförenings Förhandlingar.
Bulletin Générale de Thérapeutique.	Kronika Lekarska.
Gazette de Gynécologie.	Annali Universali di Medicina e Chirurgia.
Gazette Hebdomadaire de Médecine et de Chirurgie.	Archivio di Orthopedia.
Gazette Hebdomadaire des Sciences Médicales de Montpellier.	Gazzetta degli Ospitali.
Gazette Médicale de Nantes.	Gazzetta Medica di Torino.
Gazette Médicale de Paris.	La Medicina Contemporanea.
Journal de Médecine de Paris.	La Rassegna.
L'Abeille Médicale.	Giornale Italiano delle Malattie Venere e della Pelle.
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Les Nouveaux Remèdes.	Rivista Internazionale di Medicina e Chirurgia.
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Glasgow Medical Journal.	Deutsche medicinische Wochenschrift.
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AN EXPERIMENTAL RESEARCH UPON RABIES.

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PASTEUR's work upon and claims in regard to rabies are so well known, more particularly the latter, that any detailed account of them would be superfluous here. Starting with material obtained from a child dead of supposed rabies, in one of the Paris hospitals, he inoculated various animals in different ways—as a result, obtaining a series of symptoms in the inoculated animals of such unvarying character that he classed them under the same head, and considered them to be due to the same cause. Taking the source of his original material into consideration, he felt justified in saying that what symptoms he obtained in his experiments were those of rabies, and that the material with which his inoculations were made contained the specific virus of that disease.

Going on with his work, and extending it in different directions, he announced, first, that by various modifications in treatment to which this “virus” could be subjected its strength could be altered and diminished, and that, by inoculating animals with a virus thus modified an immunity could be established in animals thus treated, against an inoculation with virus of the greatest strength, or against the bite of a rabid animal. Reversing this process, he found that the protective influence was equally established, if the protective inoculations were made *after* the injection of the strong virus, or the bite, had occurred, provided always that the period of incubation of the disease had not passed, and that the symptoms had not made their appearance.

These propositions he proved, or seemed to prove, by a very large number of experiments upon animals, and those most intimate with the results obtained were satisfied that healthy animals—dogs in particular—

could be protected by the measures which he suggested from an attack of rabies after being bitten by a rabid animal.

The next step in this work of Pasteur's, and the one which has attracted so much attention all over the world, was the application to human beings of his methods for the prevention of rabies after a bite by a rabid animal. The preventive inoculations against rabies in human beings began in the summer of 1885, and have been continued ever since, the statistics of results being furnished to the world by means of occasional summaries in the *Comptes Rendus*.

The criticisms to be made against Pasteur in connection with this work are, in the first place, that he fails to give as full details of the individual experiments by which his results have been obtained, as he should have done. By this omission, ground for dissent is given where none might have existed, if scientific men had had the full data before them. In the second place, this omission of detail makes it impossible to know—certainly from any published work of Pasteur's—whether his so-called "virus of rabies," with which his experiments of to-day are conducted, is the continuation of the virus originally obtained from one child, or whether he has taken the opportunity to control the original virus, by obtaining a fresh supply from rabid animals or men coming under observation since the time his investigations first began. In other words, do all of the results which he has obtained depend for their justification upon the reality of a case occurring a number of years ago?

The conditions of the case being as stated, it is hardly to be wondered at that the method of preventive inoculation against rabies has been subjected to severe animadversions, which have at times included its author, and, because the conditions are such as they are, independent observations, and control experiments by, as far as possible, unprejudiced observers are absolutely necessary before the full acceptance of Pasteur's assertions can fairly be demanded of the scientific world at large.

Such independent observations and control experiments may be made to cover a very wide field of investigation, but would include, first of all, the question as to whether others can obtain the same results as does Pasteur—using the same virus, in the same way that he does; secondly, whether this virus which he uses is the true virus of rabies,—a point which will be spoken of more at length further on; and lastly, a more successful attempt than has yet been made to discover the active principle in the material used for inoculation; this active principle seeming, by analogy, to be something with a power of self-reproduction.

So far as concerns the interests of humanity at large, the first is the most important point to be considered, and the endeavor must be made to find out whether—independently of Pasteur's laboratory—there is a virus which, when inoculated in animals, produces the results claimed; whether that virus can be modified in its strength by the treatment he proposes; and lastly, whether, by using this modified virus in a certain

way, an attack of rabies can be prevented. As a corollary to these, the question must be answered as far as possible whether any other material treated in the same way will produce the same symptoms when injected into animals.

It is evidence upon these points in particular, which it is desired to present in the following pages.

Upon the 2d of last July (1886), I received from Dr. Hamilton Osgood two rabbits, one of which had been inoculated upon the 19th or 20th of June, in Pasteur's laboratory, and had died on the 28th of June, and been kept upon ice since that time; the second of which was inoculated on the 21st of June in Pasteur's laboratory by Pasteur himself, and in Dr. Osgood's presence, and, alive when received, died on the night of July 4th. From these two rabbits the material for the series of experiments given in this paper was obtained, and the authenticity of the virus, as coming from Pasteur, is unquestionable.

The method of inoculation is well known, but a brief recapitulation will do no harm. The cord of a rabbit or other animal dead of rabies is removed as quickly as possible after death, and with all precautions against contamination. A small portion of this cord, of the medulla, or of the brain, is first beaten up in a little distilled or sterilized water to soften it, and then an emulsion is made of it by beating up this mixture with a small amount of neutral sterilized bouillon. This mixture is allowed to stand, and when the larger portions of the nervous tissue have sunk to the bottom of the vessel, the supernatant cloudy fluid is used as an injecting material. This entire process, against which much criticism has been directed, is merely *a method* by which a convenient form of injecting mass may be obtained. There is nothing in the least mysterious about it—water alone, bouillon alone, or any other equally bland and innocuous fluid may be employed, but in following an experimenter's work his exact methods should be used, and that has been done in this case.

Upon the receipt of the rabbits spoken of, the first question was, do the cords of these animals contain such material that, when inoculated into others, a constant series of symptoms will be produced with such unvarying regularity that the term "specific" can be applied to the cause producing them? With a view to determining this question, inoculations were begun at that time, and have been continued ever since, with the results given below. The inoculations given in this table were all made by trephining the skull, and the injection, immediately under the dura mater—not into the brain substance—of a very small amount of the fluid prepared as described above. At the head of the table stands the abbreviated record of the two rabbits inoculated in Pasteur's laboratory—including the date of inoculation and of death. Following this comes a tabulated statement of the rabbits which have been inocu-

lated in the regular way by trephining for the purpose of carrying on the virus and of observing the manner of symptoms resulting from such inoculations. The first column gives the number of the rabbits in this table; the second column (in Roman numerals) shows the number, as it stands in the original notes, of the animal from which the virus was taken; the third, fourth, and fifth columns explain themselves.

TABLE I.

First rabbit inoculated in Paris, June 19 or 20, 1886. Dead June 28th. Received July 2d.

Second rabbit inoculated in Paris, June 21st. Received July 2d. Died July 4th.

All of the inoculations given below were done by trephining.

No.	Inoculated from	Date of inoculation.		Appearance of symptoms.		Date of death.	
1	I.	July	2, 1886.	July	14, 1886.	July	20, 1886.
2	I.	"	2, "	"	14, "	"	19, "
3	II.	"	5, "	"	28, "	August	2, "
4	II.	"	5, "	"	14, "	July	20, "
5	VI.	"	20, "	"	29, "	August	2, "
6	VI.	"	20, "	"	29, "	"	6, "
7	V.	August	25, "	Sept.	2, "	September	7, "
8	V.	"	25, "	"	2, "	"	12, "
9	XI.	Sept.	7, "	"	13, "	"	20, "
					(bites.)		
					14, "		
					(paralysis.)		
10	XI.	"	7, "	"	13, "	October	2, "
					(bites.)		
					28, "		
					(paralysis.)		
11	XIII.	"	22, "	"	29, "	"	3, "
12	XIII.	"	24, "	October	4, "	"	7, "
13	XVI.	October	4, "	"	11, "	"	16, "
14	Guinea-pig, II.	"	11, "	"	17, "	"	24, "
15	Guinea-pig, II.	"	11, "	"	14, "	"	22, "
16	XXI.	"	18, "	"	27, "	November	1, "
17	XXI.	"	18, "	"	25, "	October	30, "
18	XXI.	"	18, "	"	24, "	"	30, "
19	XXI.	"	18, "	"	27, "	November	1, "
20	XXIV.	"	22, "	"	30, "	"	8, "
					(very sluggish.)		
					November 1, "		
					(paralysis.)		
21	XXIII.	"	29, "	"	5, "	"	10, "
22	XXX.	Nov.	3, "	"	19, "	"	21, "
23	XXIX.	"	5, "	"	13, "	"	17, "
24	XLII.	"	17, "	"	24, "	December	1, "
25	Dog, V.	"	26, "	Decemb'r	3, "	"	10, "
26	Dog, V.	"	26, "	"	3, "	"	9, "
27	LXXIII.	Dec.	10, "	"	17, "	"	27, "
28	LXXIII.	"	10, "	"	17, "	"	24, "
29	LXXV.	"	24, "	"	30, "	January	3, 1887.
30	LXXVI.	"	24, "	"	31, "	"	6, "
31	LXXVIII.	January	8, 1887.	January	17, 1887.	"	22, "
32	LXXVIII.	"	8, "	"	16, "	"	22, "

TABLE II.

Statistics from the trephined rabbits in Table I.

No.	Time from the inoculation to the appearance of symptoms.	Time from the appearance of symptoms to death.	Time from the inoculation to death.
1	12 days.	6 days.	18 days.
2	12 "	5 "	17 "
3	23 "	5 "	28 "
4	9 "	6 "	15 "
5	9 "	4 "	13 "
6	9 "	8 "	17 "
7	8 "	5 "	13 "
8	8 "	10 "	18 "
9	6 "	7 "	13 "
10	6 "	19 "	25 "
11	7 "	4 "	11 "
12	10 "	3 "	13 "
13	7 "	5 "	12 "
14	6 "	7 "	13 "
15	3 "	8 "	11 "
16	9 "	5 "	14 "
17	7 "	5 "	12 "
18	6 "	6 "	12 "
19	9 "	5 "	14 "
20	8 "	9 "	17 "
21	7 "	5 "	12 "
22	16 "	2 "	18 "
23	8 "	4 "	12 "
24	7 "	7 "	14 "
25	7 "	7 "	14 "
26	11 "	6 "	17 "
27	7 "	10 "	17 "
28	7 "	7 "	14 "
29	6 "	4 "	10 "
30	7 "	7 "	14 "
31	9 "	5 "	14 "
32	8 "	6 "	14 "

TABLE III.

Averages, etc., from Table II.

Shortest period of incubation after trephining	3 days.
Longest	23 "
Average	8.6 "
Shortest period from the appearance of symptoms to death	2 "
Longest	19 "
Average	6.4 "
Shortest period from inoculation to death	10 "
Longest	28 "
Average	14.9 "

From these tables it may be seen, *first*, that, by inoculating animals—rabbits—in the way prescribed—*i. e.*, by trephining and injecting a small portion of an emulsion of a "rabid" cord under the meninges, certain symptoms occur after a period of incubation of varying duration, and that these symptoms are invariably followed by death. *Secondly*, that while the variation in length, of the period of incubation,

and of the time from the appearance of the symptoms until death, varies considerably between individual cases, nevertheless the *average duration* of each of these periods corresponds very closely indeed with the figures given by Pasteur, and quite as closely as a so comparatively small number of experiments could be expected to do.

This correspondence of results is very interesting and important—furnishing, as it does, the first firm ground of belief which would induce a sceptic to go on with further investigations.

The *symptoms* found in all of these animals have been practically identical, so that a description of one case furnishes a picture of what occurred in all. After the operation of trephining and inoculation was completed, the animal would remain stupid from the effects of ether for from fifteen minutes to half an hour, but sometimes not even so long. The most successful operations are performed with practically no loss of blood. After the effects of the ether have passed, the rabbit is apparently as well and bright as ever, and certainly, if one may judge by its appetite, it suffers no shock or any other disturbance from the operation.

Seen at the time and for some days afterward, there is not the slightest sign of any event having occurred out of its ordinary experience. The first thing abnormal which usually makes its appearance, or which is noticed, is a slight weakness of the hind legs—a slight unsteadiness as the animal jumps from one side of the cage to the other. This unsteadiness very often disappears entirely, if the animal be forced to make three or four jumps; it is as if a little stiffness or lameness were removed by exercise. This weakness sometimes makes its appearance suddenly, being very marked in animals which fifteen minutes before were seen to be perfectly strong, so far as close scrutiny could detect.

Before this beginning paralysis can be detected, there is, occasionally, a decided change in the character of the animal; from being lively and affectionate it becomes dull and sluggish, and even fierce—if such a term may be applied to a rabbit; in the latter case it will jump at and bite objects held toward it, and may even growl and spit at them, showing every evidence of a desire to do harm. Such a condition as this is not common, however, and the first symptom which makes a decided impression upon the observer is, usually, that of the unsteadiness of the hind legs already spoken of. This paralysis of the hind legs is progressive in intensity and in character. It passes from the posterior extremities to the anterior, and increases until, at last, the animal lies upon its side entirely unable to move. It is, distinctly, a loss of motor power; reflex action remains until life is actually extinct. The power of deglutition is lost in twenty-four or more hours from the first appearance of any symptoms—and it was at one time supposed that death was caused by starvation. This can hardly be the case, however, inasmuch as the stomach is always full of partially digested food, and the tissues are not

sufficiently wasted to warrant the supposition. Opisthotonos is early marked, and continues in an extreme degree after life is extinct. Before the paralysis has progressed so far that no motion is possible—there is at times a very considerable degree of restlessness—the animal struggles laboriously from one side of the cage to the other, without apparent object, falling over at almost every step. Just before death, there seems to be a revival of the powers—as manifested by a renewal of these struggles;—these movements disappear, absolute quiet ensues, and death occurs so easily that it is oftentimes impossible to tell whether life is or is not extinct. Whilst the symptoms last, the pulse, respiration, and temperature vary in an extreme degree, from very low to very high, and *vice versa*; the variations being entirely without rhythm or symmetry, and apparently coinciding somewhat with the amount of muscular effort the animal may be making at the time. There is never any diarrhœa, no increase in salivary secretion, and no constant or peculiar change in the appearance of the mucus membrane of the mouth or fauces.

These are the appearances which have been presented in every animal recorded in this paper; not only in those which have been inoculated by trephining, but also in those which have succumbed to subcutaneous injection.

The appearances seen upon post-mortem examination are as uniform as are the symptoms which precede death; and, again, a description of one animal is practically a description of all. Naturally, the point of inoculation and the nervous tissues are the objects of greatest interest. If the inoculation has been by subcutaneous injection, the puncture through the skin may sometimes be made out by the presence of a minute spot of pigmentation, but there is never any sign of a local disturbance. If trephining has been performed, there is sometimes to be seen a very slight elevation of the brain substance under the point in the skull from which the button of bone has been removed. This is as often absent as present, but might be expected to occur by reason of the lack of the usual pressure at the point where the bone has been disturbed. There is never to be seen any sign of suppuration at the point of inoculation, or, for that matter, anywhere else; nor is there any other indication of a local disturbance. In *all cases*, however, whether the inoculation has been by trephining or by subcutaneous injection, the removal of the calvarium shows a congested condition of the membranes of the brain, without, however, any adhesive inflammation of the meninges. The cerebral sinuses are full of dark, clotted blood, but beyond this there is nothing to be seen in the brain. The brain substance is normal in color and consistency, and there are no spots indicating hemorrhage or emboli. The same conditions hold upon laying bare the spinal cord. The vessels of its membranes are sufficiently congested to give it a pinkish look, which disappears almost entirely when these membranes are removed,

and the cord itself presents to the eye almost precisely the glistening white appearance of that of an animal which has been killed by chloroform or ether. In this case, as in the brain, the color and consistency are normal. (It has seemed to me as if there was more congestion in the venous sinuses of the cord membranes in the sacral, lower dorsal, and cervical regions; whether this is accounted for by the anatomical structures of the parts, I am not sufficiently skilled in comparative anatomy to decide.)

The internal organs of the thorax and abdomen present nothing unusual. The heart is always full of dark blood, and has ceased beating in diastole. The lungs are healthy in appearance, of a bright red color, and sometimes show localized spots of a dark red, which are situated on the side upon which the animal was lying when it died. The stomach is usually full of half-digested food, and occasionally shows spots of post-mortem digestion, along the greater curvature for the most part. There is not any marked congestion of its mucous membrane. The small intestine is empty; the rectum full of well-formed normal feces; the bladder is sometimes enormously distended with a clear, amber-colored urine of a low specific gravity and alkaline reaction; at other times it contains a moderate amount of fluid, with a very heavy deposit. A sample analysis by Drs. Wood and Harrington, of the Harvard Medical School, is as follows: Sp. gr. 1.036; reaction very acid; sediment excessive; albumen 0; sediment: amorphous urates, acid urate of sodium, spermatozoa, and mucous casts, some of which were evidently from the kidneys.

The kidneys are normal in appearance; the liver and spleen are sometimes full of blood, and, rarely, somewhat anæmic; the vessels of the mesentery and of the skin are always full of blood, so that the smallest branches may be easily traced.

In none of the animals upon which post-mortem examinations have been made has there been noticed the extreme degree of congestion of the internal organs upon which so much stress has been laid. The absence of this appearance is at least in part readily explained. The animals here spoken of were, during the whole time they were under observation, kept isolated and free from any disturbance whatever, so that no excitement other than that incidental to the disease was produced. On the other hand, clinically speaking, the instant an animal is suspected of rabies it is persecuted and chased from one corner to another, until, unless frightened to death, it is put out of existence by clubs and stones. Under such conditions as these, congestion and even hemorrhage of the internal organs are but the natural result. The absence of the classic "period of excitement" in so many of the animals here recorded may very probably be ascribed to the same circumstances of quiet surroundings and freedom from annoyance. This "period of excitement" is all that makes the

difference in the books between the "furious" and the "dumb" forms of rabies. It precedes the appearance of paralysis, if it occurs at all, and is always terminated by the paralysis.

Taking into consideration the condition of things as it must be in the brain and cord, with each individual cell struggling against some foreign element, it is not difficult to understand how easily these disturbed cells may send various messages to the muscles, and how easily these messages may result in manifestations of excitement. From such a point of view, it is hardly rational to consider the "furious stage" as anything more than a chance appearance in the course of rabies, the likelihood of its presence being diminished as those things tending to excitement are taken away.

In order not to give any ground for the criticism that the results in this paper are too favorable, and in order not to claim too great perfection for the operator's skill, every animal used in this investigation will be spoken of, and where a variation from the results expected has occurred, the explanation, if there is any, will be given in accordance with the facts observed.

The first series of experiments which comes under this head is that which includes those rabbits which were meant to show the usual symptoms—were inoculated for that purpose—and yet failed to do so. These experiments will be found in the following table:

TABLE IV.

No.	Date and method of inoculation.	Result and explanation.
1	Inoculated by trephining, Sept. 22, 1886.	Dead, September 23. Blood-clot on brain. Injury to longitudinal sinus.
2	Inoculated by trephining, Sept. 24, 1886.	No symptoms. Killed Dec. 21, 1886. Dura mater not pierced by syringe needle, and virus washed out.
3	Inoculated by trephining, Oct. 4, 1886.	Savage Oct. 13 to 23, then no signs. Killed on December 21, 1886. Virus partially destroyed (attenuated) by heating.
4	Inoculated by trephining, Oct. 22, 1886.	Sluggish Oct. 30; savage Nov. 5; no signs on 7th. Killed Dec. 22. Virus partially destroyed by heating (attenuated).
5	Inoculated by trephining, Oct. 29, 1886.	Slight paresis Nov. 6; none on 7th; savage 10th to 14th. Killed Dec. 22, 1886. Virus attenuated by heating.
6	Inoculated by trephining, Nov. 3, 1886.	No signs. Killed December 23, 1886. Virus destroyed by heating.
7	Inoculated by trephining, Nov. 5, 1886.	Sluggish on 14th and 15th, then well. Killed December 23, 1886. Virus attenuated by heating.
8	Inoculated by trephining, Nov. 17, 1886.	No signs thus far, January 25, 1887. In this case syringe leaked, and it is doubtful if any of the material was introduced.

Thus it appears that there are eight animals which may be counted as failures; that is to say, the results were not as they were intended to be. Of three, the note appended to Nos. 1, 2, and 8, explains itself; of the others, Nos. 3 to 7, it is stated that the virus was more or less affected by heating in all of them, and this needs a little explanation. The way in which this mistake—for it was one in these cases—occurred, was as follows: It was not always possible to use the animals for inoculation immediately after death, and where this was the case, the bodies were at once frozen to prevent any change. In preparing some of these animals for use they were placed, by a mistaken idea of an assistant, in the *steam sterilizer* in order to hasten the thawing process. The heating was carried too far, and, as a result, the strength of the virus was diminished or destroyed entirely. This table, therefore, does not in the least weaken the force of the first one, but rather seems to show what may happen even when the operator himself takes all the precautions required. The cases where the heating of the animals occurred are also of value, as showing how readily a rise of temperature affects the virus in the cords.

This point will be found illustrated further on by experiments purposely made to test it.

Passing from obtaining such systematic results as are detailed in Table I., the questions arise, How does a variation of the inoculating material influence the result? Does a change in the fluid used produce a change in the symptoms, or are these symptoms simply the result of the introduction of any foreign substance under the meninges of the brain? This point, put in the form of the broad assertion, that nothing but this virus will produce these symptoms, would have to be supported by a very large series of experiments, and this has not been attempted. That variations, or rather a non-appearance of the symptoms, may be the result of changes in the material introduced, is well shown in the accompanying summary.

TABLE V.
Control experiments upon rabbits.

No.	Date of inoculation.	Method and material used.	Result.	
1	Aug. 2, 1886.	By trephining. Virus heated 5 m. to 110° F.	No symptoms. 28, 1887.	Well, January
2	Aug. 2, 1886.	The same.	No symptoms. 28, 1887.	Well, January
3	Sept. 24, 1886.	By trephining. Bouillon and water without any cord.	No symptoms. 28, 1887.	Well, January
4	Sept. 24, 1886.	The same.	No symptoms. 28, 1887.	Well, January

No.	Date of inoculation.	Method and material used.	Result.
5	Oct. 11, 1886.	By trephining. Emulsion of cord dried at 20° C. for ten days.	Very slight paresis, October 20th and 21st. Well, January 28, 1887.
6	Oct. 11, 1886.	The same.	Very slight paresis, October 21st. Well, January 28, 1887.
7	Oct. 19, 1886.	By trephining. Emulsion of cord of healthy rabbit.	No symptoms. Well, January 28, 1887.
8	Oct. 19, 1886.	The same.	Died <i>suddenly</i> , Nov. 19, 1886. Liver stuffed full of coccidium oviforme nodules.
9	Oct. 19, 1886.	The same.	Died <i>suddenly</i> , Nov. 7, 1886. Liver stuffed full of coccidium oviforme nodules.
10	Oct. 19, 1886.	The same.	No symptoms. Well, January 28, 1887.

The results here tabulated show that in every instance—other conditions being exactly the same—of inoculation by trephining with material different from the usual emulsion of the cord of an animal dead with the paralytic symptoms, nothing occurred which could by any possibility be ascribed to the inoculations except twice. The two cases where slight paresis was observed (5 and 6) only indicate that the strength of the virus was diminished by the drying of the cord used. The two cases in which death occurred (8 and 9) showed absolutely none of the regular signs; there was no change in disposition, no paralysis, no period of incubation, and the post-mortem examination showed the presence of enormous numbers of what looked like miliary tubercles with a few small abscesses. These changes were confined to the liver in both cases. Upon microscopic examination these nodules were found to be *not* produced by tuberculosis, but by the “coccidium oviforme”—a parasite not uncommon in rabbits. (Leuckart, *Parasites of Man*, 1886, p. 203, *et. seq.*)

These results, together with all the others mentioned in this paper, teach us that suppuration is not only not a necessary accompaniment of inoculations after Pasteur's method, but that the moment suppuration appears the experiment is vitiated, so far as proving or disproving anything of Pasteur's assertions is concerned. This is of special importance in connection with Spitzka's paper published in *The Journal of Comparative Medicine and Surgery* for July, 1886, under the title of “How Can We Prevent False Hydrophobia.” This author distinctly states that he does not wish to touch upon the question of the existence of such a disease as true rabies, but, at the same time, his authority is quoted, as well as his experiments, to prove that there is no such thing, and, *especially*, that any putrescible substance will produce regularly, after a period of incubation, the paralytic symptoms claimed to arise

from a specific virus. Surely there is nothing in six experiments, incompletely reported, to warrant such an assertion. In the account of the autopsies, only two are given; *purulent meningitis* was found in one case, and *inflammatory red softening* of great extent in the other, together with, in this latter case, a blood-clot, and congestion and tumefaction of the hemisphere on the side upon which the operation was performed! Of course, if any results whatever are to be quoted as arguments in such a case as this, and if symptoms due to any sort of injury to the brain with results differing entirely from those of Pasteur are to be considered as disproving the occurrence of uniform results and pathological appearances, discussion is useless.

Still more striking than any of the results already detailed, were a series of experiments made upon guinea-pigs. These experiments were additional control work, to determine the *specific* nature of the virus employed, and the results obtained, in view of work done at other times, are exceedingly emphatic. An emulsion of the cord and medulla of a rabbit dead with the usual symptoms was prepared in the usual way, and three minims of the solution were injected subcutaneously in the right groin of the full-grown, healthy guinea-pigs. The usual precautions against contamination were taken, and the results are given in the following table.

TABLE VI.
Subcutaneous inoculation of guinea-pigs.

No.	Date of inoculation.	Date of appearance of symptoms.	Result.
1	Sept. 22, 1886.	Sluggish, and slight paresis, October 11th to 16th. Well on 17th.	No symptoms from October 17th. Killed December 27th. No changes.
2	Sept. 22, 1886.	Paresis October 9th.	Dead Oct. 10th. Usual congestion of membranes of cord.
3	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
4	Sept. 22, 1886.	Paresis October 13th.	Dead Oct. 16th. Usual congestion of membranes of brain and cord.
5	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
6	Sept. 22, 1886.	No symptoms.	Killed Dec. 27th. No changes.
7	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.
8	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.
9	Sept. 22, 1886.	Paresis October 9th.	Dead Oct. 3d. Usual congestion of membranes of brain and cord.
10	Sept. 22, 1886.	No symptoms.	Killed Dec. 29th. No changes.

Here it may be seen, that in four out of the ten animals inoculated symptoms made their appearance which could be referred only to a disturbance of the nervous centres, and in three of these four animals the appearance of the symptoms was followed by an increase in their severity

and extent with a fatal termination. This result is especially striking in view of the fact that in other experiments a very large number of inoculations have been made with all kinds of pathogenic and non-pathogenic bacteria, in the same way, and in the same species of animal, and yet the writer has never seen any result like that here recorded. Lesions extending from a miliary abscess at the point of inoculation to a general septicæmic or tuberculous process have been obtained, but never under any circumstances anything which seemed in the least like a disturbance of the nervous centres. To a practical bacteriologist, therefore, the results given in the preceding table are especially convincing. In no case was there the slightest indication of a local disturbance at the point of inoculation; the skin was as if it had never been touched, so much so, that recourse to the record was necessary to determine where the inoculation had been made.

As a further proof that the symptoms observed in the dead guinea-pigs were in reality due to the same cause as was producing similar conditions in rabbits all the time, the cord of one of the animals was removed, beaten up with distilled water and bouillon in the usual way, and inoculated by trephining into two rabbits. The result was confirmatory, the two animals showing the usual symptoms; the appearance of weakness of the hind legs increasing to general paralysis followed by death. These results are tabulated below.

TABLE VII.

Test of cord of guinea-pig upon rabbits.

No.	Date and method of inoculation.	Appearance of symptoms.	Result.
1	By trephining. Oct. 11, 1886.	Symptoms of paresis Dec. 12th.	Death Oct. 24th, with the usual appearances in membranes of brain and cord.
2	By trephining. Oct. 11, 1886.	Sluggish on 14th, paresis on 15th.	Death Oct. 22d, with the usual appearances in membranes of brain and cord.

Of course, no such investigation as the present would be complete unless observations were also made upon dogs. These animals were used, but not to anything like the same extent as rabbits, for the reason that the behavior of the "specific virus" in rabbits is the point upon which the greatest stress is laid and upon which so much depends. In the dogs experimented upon, the conditions were made precisely the same as obtained in the work upon rabbits. The instruments were sterilized with the same regularity, the operations were performed in the same way, and the material used for inoculation was, as in the other cases, an emulsion of the brain and cord of an animal previously inoculated with similar material. Another reason for not making more

numerous experiments upon dogs is the fact that in every case in which the conditions of a successful inoculation have been fulfilled, the result has been the same, the production of identically the same symptoms in dogs as have always appeared in rabbits treated in the same way; these symptoms coming on after a "period of incubation" extending over from eight to twelve days, then increasing in severity, and finally terminating in death.

The result of these experiments upon dogs is given in the accompanying table:

TABLE VIII.
Inoculation experiments upon dogs.

No.	Manner and date of inoculation.	Symptoms appeared.	Result.
1	By trephining. Nov. 9, 1886.	Paresis, Nov. 21st.	Dead, Nov. 25, 1886.
2	By trephining. Dec. 10, 1886.	Paresis, Dec. 20th.	Dead, Dec. 26, 1886.
3	By trephining. Dec. 10, 1886.	Paresis, Dec. 20th.	Dead, Dec. 26, 1886.
4	By trephining. Dec. 15, 1886.	Paresis, Dec. 20th.	Dead, Dec. 27, 1886.
5	By trephining. Dec. 15, 1886.	Dilated pupils, Dec. 24th; paresis, Dec. 26th.	Dead, Dec. 30, 1886.

In order to be sure of the virus, the cord of one of these dogs was tested by inoculating into rabbits, with the production of the usual symptoms; the rabbits were trephined and inoculated in the usual way; the paralysis made its appearance at the usual time, spread in the usual way, and ended fatally, as usual. The results are given in Table IX.

TABLE IX.
Test of cord of dogs upon rabbits.

No.	Date and method of inoculation.	Symptoms appeared.	Result.
1	Trephined, Nov. 26th.	Symptoms. Dec. 3d.	Death, Dec. 10th.
2	Trephined, Nov. 26th.	Symptoms. Dec. 3d.	Death, Dec. 9th.

This is but a small number of experiments, taken by themselves; their exact correspondence with those made upon other animals is their essential value. In every case, not only were the symptoms during life the same as those observed in rabbits and guinea-pigs, but the appearance upon post-mortem examination was the same, with the single exception that the stomach was entirely empty, except in two cases, in which a small amount of *hair* was found. (In rabbits the stomachs were always full, although this cannot be said to mean much after all, in the face of the assertion of physiologists that one can never empty a

rabbit's stomach, even by prolonged starvation.) In none of the dogs were there any prolonged periods of excitement or fury seen; such a condition as the "furious" stage was entirely absent. They were all subject to short fits of restlessness, during which they moved quickly and aimlessly from one side of the cage to the other. At these times they would occasionally cry out, and sometimes would appear as if in extreme pain; shortly afterward they would sink into a sort of lethargic state, from which it was extremely difficult to rouse them. To what extent these short periods of restlessness would have been extended if the animals had been at large, and how near they would have approached the classic "fury" of a rabid dog, it is, of course, impossible to say. As a matter of fact, the dogs were kept confined and entirely protected from any but the most necessary disturbance, and any alienist has daily experience of the sedative effect of quiet and seclusion upon his patients. In only one case was there any marked desire to bite, and that was only manifested after the animal had been disturbed, as would naturally be the case at any time with a dog sick of any disease. The membranes of the brain and cord were always congested, but there were no localized symptoms at the point of inoculation, nor any greater disturbance on the side where the inoculation had been made; most important of all, there was not the slightest indication of any suppuration.

Before concluding this part of the paper, which has had for its object the determination of the existence of the specific virus called that of rabies, the same thing is to be done here as in the case of the rabbits—the unexpected results and failures in the inoculation of dogs must be recorded. This is done in Table X.

TABLE X.

Failures of inoculations upon dogs.

No.	Date and method of inoculation.	Symptoms appeared.	Result.
1	Subcutaneous injection, Sept. 7, 1886.	No symptoms.	Killed Dec. 10th. No changes.
2	Subcutaneous injection, Sept. 7, 1886.	No symptoms.	Killed Dec. 10th. No changes.
3	Trephined, Oct. 29, 1886.	Symptoms, Nov. 4, 1886.	Dead Nov. 11th. Compression of brain by blood-clot.
4	Trephined, Dec. 10, 1886.	Symptoms, Dec. 11, 1886.	Dead Dec. 13th. Brain injured by trephine; spot of softening about point of injury.

The first two of these animals were inoculated by subcutaneous injection; after being kept under observation for three months they were killed, as no symptoms had appeared. The last two cases explain themselves: in the first, the longitudinal sinus was pierced, and in the second

the trephine slipped during the operation and entered the brain, the result being the same as would occur in any other such injury.

The work already recorded seems to show pretty definitely, that there is a specific virus contained in the cords of rabbits inoculated with the material and in the way spoken of by Pasteur. This point having been settled, the question arises, Is it true that by certain procedures this virus can be diminished in strength, and can animals be protected from an attack of rabies after inoculation with that disease by the method suggested by Pasteur—in other words, does “protection” protect? The remainder of the work done in this investigation has been completed with the object of illustrating this point.

The principle of “protective inoculation” is drawn from these facts: That the cord of an animal dead of rabies, if promptly removed and kept at an even temperature (20° C.), and in a dry atmosphere, will gradually lose its virulence, so that, at the end of ten or twelve days, this virulence will be entirely gone; and that this loss of virulence is gradual and progressive, *not* sudden. The *theory* is, that by injections on successive days, of emulsions of cords of increasing virulence, an immunity is established against an attack of the real disease, or, what is the same thing, against an inoculation with the strongest virus, and that this “immunity” is established whether the inoculation, or bite, occurs before, or after, the protective measures are taken. As a corollary, it follows, of course, that if the inoculation, or bite, occurs before protection, the protection, to be effective, must be completed before the period of incubation of the disease has passed; that is to say, before any deep impression has been made upon the nervous centres.

For the purpose of protective inoculation, cords are to be removed immediately after death with all possible precautions against contamination. They are then suspended in sterilized jars, stoppered with cotton-wool, and containing some hygroscopic material to promote the absorption of moisture. The jars are kept in a dry chamber, as nearly as possible at a temperature of 20° C., and portions of the cords they contain are used for injection as occasion requires,—the cords being made into an emulsion in the usual way. This is the method; but to have everything ready for a protective inoculation at any given time, some calculation is necessary, and a number of rabbits must have been inoculated, so that they will die on the day that it is necessary to begin drying the cords, so that these cords shall be of the proper intensity of virus on the days they are needed. This, for a single series of protective inoculations, when it is known at what date the protection must begin. If the desire is to be ready to perform these protective inoculations at any time, a little reflection will show that rabbits must be inoculated every day, at least one must die every day, and that the cord must be removed and

the drying begun every day. Of course, such work as this can be carried out only at the expense of much time, labor, and money, and it appears at once how much more easy it is to condemn the method by the facility with which inaccurate results may be obtained, than it is to test its merits thoroughly by exact observation.

In the work detailed below, the first procedure was preparing the rabbits so that the inoculations with the strong virus could be made upon the 10th of November, 1886, and the protective inoculations could be begun upon the following day. What was done may be thus tabulated: Rabbits had been previously inoculated so that it was possible on

TABLE XI.

Nov. 1.	To prepare a cord for use on 11th (10 days).
" 3.	" " " 12th (9 days).
" 5.	" " " 13th (8 days).
" 7.	" " " 14th (7 days).
" 9.	" " " 15th (6 days).
" 10.	Rabbits were inoculated with virus of full strength and protection begun.
" 11.	With cord of 1st (10 days drying) and cord prepared for use on 16th
" 12.	" 3d (9 ") and cord prepared for use on 17th [5 days.
" 13.	" 5th (8 ") and cord prepared for use on 17th [4 days.
" 14.	" 7th (7 ") and cord prepared for use on 18th [3 days.
" 15.	" 9th (6 ") and cord prepared for use on 19th [2 days.
" 16.	" 11th (5 ") and cord prepared for use on 20th [1 day.
" 17.	" 13th (4 ") and cord prepared for use on 20th [1 day.
" 18.	" 15th (3 ") and cord prepared for use on 20th [1 day.
" 19.	" 17th (2 ") and cord prepared for use on 20th [1 day.
" 20.	" 19th (1 ") and protective inoculation was completed upon this day, the 20th.

The value of this method of procedure was tested upon four series of rabbits in four different ways: *First*, by the subcutaneous injection of virus of the strongest quality, and the following of this on successive days for ten days by the subcutaneous injection of virus of progressively increasing strength, as shown in the preceding table; *second*, by carrying out the protective measures, as above, first, and then injecting the strong virus; *third*, by inoculation with the strong virus first, *by trephining*, and then protecting by subcutaneous injection on ten successive days; *fourth*, by protection first by subcutaneous injection, and then inoculation with the strong virus *by trephining*.

The first test is unquestionably the most important and its results are especially striking, for the reasons that the conditions observed approach nearest to what occurs in real life, and because it is against such subcutaneous inoculation—by bites—that the protective measures are adopted in human beings. The results of the test in regard to the first point are given in the following table:

TABLE XII.

Protective inoculations in rabbits—1. By subcutaneous injection; inoculation first, and then protection.

No.	Date and method of inoculation.	Protective injections.	Result.
1	Nov. 10, 1886. Subcutaneous injection.	Protected Nov. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, with cord 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 day old respectively.	No symptoms. Well Jan. 30, 1887.
2	The same.	The same.	The same.
3	The same.	The same.	The same.
4	The same.	The same.	The same.
5	The same.	The same.	The same.
6	The same.	The same.	The same.
7	The same.	The same.	The same.
8	The same.	The same.	The same.
9	The same.	The same. Symptoms Nov. 24.	The same. Dead Nov. 28.

At the same time that these animals were inoculated, a second series was treated in the same way, and with the same virus, and left unprotected, as seen below.

TABLE XIII.

Control of virus used in Table XII. Subcutaneous injection of rabbits, without subsequent protection.

No.	Date and method of inoculation.	Symptoms.	Result.
1	Nov. 10, 1886. Subcutaneous injection.	No symptoms.	Well Jan. 30, 1887.
2	The same.	Symptoms Jan. 8, 1887, paresis.	Dead Jan. 12, 1887.
3	The same.	Symptoms Nov. 23, paresis.	Dead Nov. 27, 1886.
4	The same.	Symptoms: Fierce on Nov. 22; paresis on Nov. 27, 1886.	Dead Nov. 30, 1886.
5	The same.	Symptoms: Fierce on Nov. 28 to Dec. 8; paresis Dec. 8.	Dead Dec. 13, 1886.
6	The same.	Symptoms of paresis Nov. 27.	Dead Nov. 30, 1886.
7	The same.	Symptoms of paresis Dec. 3.	Dead Dec. 8, 1886.
8	The same.	No symptoms.	Well Jan. 30, 1887.
9	The same.	Symptoms of paresis Dec. 3.	Dead Dec. 7, 1886.

These two tables present a very strong contrast: upon the first, one death is recorded; and upon the second seven are noted. In the first case, the symptoms appeared on the fourth day after the protective injections were completed, and it is perfectly justifiable to suppose that in this case the period of incubation of the original inoculation was too short to permit the protective measures adopted to take full effect. On the other hand, the seven deaths recorded on Table XIII., out of nine rabbits, inoculated and left unprotected, show that the virus used was possessed of great active properties, and the inference is warrantable that some influence for good was exerted by the measures adopted in the first series, subsequent to the injection of the strong virus. The

symptoms of the rabbits which were affected were the same in all cases, and these and the gross pathological appearances correspond exactly with those already detailed, as seen in the rabbits in Table I.

The results of testing the protective injections in the three other ways spoken of, are given below in Tables XIV., XV., XVI., and XVII.

TABLE XIV.

Protective inoculation in rabbits—2. By subcutaneous injection; protection first, and inoculation with strong virus.

No.	Protected.	Inoculated.	Result.
1	Nov. 11 to 20, with cords 10 to 1 day old.	Subcutaneous injection with strong virus, Nov. 29, 1886.	No symptoms. Well Jan. 30, 1887.
2	The same.	The same.	The same.

TABLE XV.

Protective inoculations in rabbits—3. Inoculation by trephining; inoculation first, and then protection.

No.	Date and method of inoculation.	Protected.	Symptoms.	Result.
1	Nov. 10, 1886. By trephining.	Protected Nov. 11 to 20, with cords 10 to 1 day old.	Paresis appeared Nov. 20.	Dead Nov 25.
2	The same.	The same.	Paresis appeared Nov. 21st.	Dead Nov. 25.
3	The same.	The same.	None.	Well Jan. 30, 1887.
4	The same.	The same.	Sluggish from Nov. 21 to 24, then well.	Well Jan. 30, 1887.

TABLE XVI.

Protective inoculations in rabbits—4. By trephining; protection first, then inoculation with strong virus by trephining.

No.	Protected.	Inoculated.	Result.
1	Nov. 11 to 20 with cord 10 to 1 day old.	Nov. 29 with strong virus, by trephining.	Sluggish Dec. 8; fierce to Jan. 1, 1887; well Jan. 30, 1887.
2	The same.	The same.	Paresis Dec. 7; dead Dec. 11.

TABLE XVII.

Attempted control of strength of virus used in Tables XV. and XVI.
Rabbits.

No.	Inoculated.	Result.
1	By trephining. Nov. 29, 1886.	No symptoms. Well January 30, 1887. (Syringe leaked badly during operation, and considerable hemorrhage occurred; probably no virus injected.)
2	The same.	Well January 30, 1887. (Longitudinal sinus opened during operation; enormous hemorrhage, and virus probably washed out.)

A study of these tables shows that no symptoms whatever occurred when the protection preceded the inoculation of the strong virus (Table

XIV.), this inoculation being made by subcutaneous injection nine days after the protective measures were completed. In Tables XV. and XVI., where the inoculation with the strong virus was made by trephining, there is recorded a loss of half the animals, when the protection preceded the inoculation, as well as when it followed it. These results are not as fatal as those of Frisch, of Vienna (*Wien. med. Presse*, Nos. 31 and 32, 1886), and, in any case, the objection that this is an unjustly severe test of the method is a valid one, the inoculations by trephining bringing the virus in immediate contact with its place of election, and not allowing for the longer period of incubation which follows a subcutaneous inoculation (bite), against which method of inoculation the preventive injections are directed.

The last table (XVII.) gives the result of two inoculations by trephining, made to test the strength of the material used in the experiments recorded in Tables XV. and XVI. They were both failures—the result being undoubtedly due to the imperfect operation, which latter was caused by haste, owing to pressure of other work. That the virus was of the full strength is shown by the results in Tables XV. and XVI., and also by the symptoms in the animal from which it was taken, and in other animals inoculated with it to carry on the virus.

The work above recorded is what has been done to prove the three propositions:

(1) Is there a specific virus in the brains and cords of rabbits inoculated with Pasteur's material and after his methods?

(2) Does the treatment by drying, proposed by him, modify the strength of this virus? And, finally,

(3) Does injection with such "modified virus" produce an immunity against an inoculation (or bite) with virus of full strength?

The experiments have been given in detail, and, with the utmost frankness, every animal experimented upon has been spoken of, and absolutely nothing has been concealed. The writer began the investigation as a sceptic—as a disbeliever in the existence of a virus which would produce such peculiar symptoms as were claimed; he had not visited Pasteur, was ignorant of his precise methods, and knew nothing more of his results than he has seen fit to publish.

The results of the work here given must speak for themselves: they certainly seem to justify a change from scepticism, complete and absolute, to a belief in, at least, a portion of Pasteur's assertions. Whether the virus used in these experiments is the virus of true rabies or not is a point which cannot be settled until an opportunity is offered for investigation of the result of inoculations with material from a fresh case of rabies in a dog or other animal—*unless* such evidence has already been obtained in Pasteur's laboratory, and *published*. If the latter is the

case such publication has escaped notice up to the date of finishing this paper.

Whether this is the true virus of rabies or not, it is something specific. It may be the true virus, or it may be the true virus altered in some degree by its long transmission from animal to animal, or it may be something entirely different and apart from the true virus; this is a point of mere scientific interest. The practical result is the same in either case, so far as concerns the application of the method to man. It is absurd to suppose that in a country like France, where rabies is so comparatively frequent, and in a series of cases so large and closely observed as that of Pasteur, a certain percentage, and that a large one, of the patients submitted to him, have not been bitten by rabid animals. This being true, even with the few deaths claimed and heralded as "failures," the percentage of fatal results among his cases is unquestionably much smaller than among those in which his method was not adopted.

Every one knows that now, in severe bites or lacerated wounds, more frequent, stronger, and repeated preventive injections are used than was the case at first. This change does not alter the *principle* of the method, however, and as it was that it was desired to test, the original *daily interval* injections were adopted in this research.

A discussion of the minute changes observed has been avoided. The study of the microscopical appearances of the various organs, especially of the brain and cord, together with the results of bacteriological research, form a part of the work by themselves. It is hoped that it may be possible to find something *specific* in this direction at some future time.

The conclusions which may be drawn from the work here recorded seem to be as follows:

I. There exists in the cords and brains of animals inoculated in Pasteur's laboratory a *specific virus*, capable of the production of similar symptoms through a long series of animals.

II. That these symptoms are produced with absolute certainty when the method of inoculation is by trephining the skull, and injection under the dura mater,—with less certainty when the inoculation is by subcutaneous injection.

III. That the strength of this virus is lessened when the cords containing it are removed from the animals and placed in a dry atmosphere at an even temperature.

IV. That the symptoms produced by the inoculation of this virus only appear after a certain period of incubation, distinctly shorter when the inoculation has been done by trephining, than when done by subcutaneous injection.

V. That injections of the virus, modified in strength by drying, and

in the manner prescribed by Pasteur, exert a very marked protective influence against an inoculation with virus of full strength.

VI. That a very moderate degree of heat destroys the power of the virus entirely, whilst prolonged freezing does not injure it.

As will be seen, all of these conclusions are in complete accord with the declarations of Pasteur; their importance lies in the fact that they were reached at a distance from him, and by work entirely separated from any personal influence or bias.

The liberality of the Medical Faculty of Harvard University gave the necessary pecuniary support to this investigation. The energetic and persistent assistance of Mr. Austin Peters, M.R.C.V.S., permitted the completion of much of the work contained in it. Dr. Osgood's great trouble in obtaining and bringing the rabbits to this country, also deserves the author's most sincere thanks.

NOTE.—This paper was prepared for the press when the later results of von Frisch came under notice. The time to investigate the full paper was too short, and the summary as given in the *Medical Record* of January 22, 1887, was made use of. The conclusions to which he has come are precisely the same as those drawn from the work in this paper, so far as they cover the same ground. His further conclusions are based upon work done with virus obtained from street rabies, and seem to establish the identity between this and the experimental virus of Pasteur. His work has led him to the expression of a suspicion, already expressed by the writer in another place, that the intensive method of preventive treatment recently recommended by Pasteur, may very possibly produce the disease. Whether von Frisch is justified in his conclusions by a sufficient number of experiments upon which to base them, the writer cannot say at present; certainly the conclusions of his previous papers upon this subject were entirely too weighty for the foundation upon which they were built.

Boston, January 30, 1887.

A NOTE ON THE MEANS OF TOPOGRAPHICAL DIAGNOSIS OF FOCAL DISEASE AFFECTING THE SO-CALLED MOTOR REGION OF THE CEREBRAL CORTEX.

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THE necessity for exact knowledge of the relations between the external surface of the head and the various encephalic regions has arisen so rapidly within the last few years as to force each practical

surgeon to work out the required facts for himself with the aid of the few papers that have appeared on the subject.

In the absence of any such desired comprehensive monograph giving a complete directory, as it were, of those parts of the brain whose function is so far understood as to admit of the localization of lesions within their boundaries, a personal experience, which has so far fortunately been equal to the exigencies of ten cases submitted to operation, may be of use to those who are similarly called upon to explore the cranial cavity.

This paper, therefore, professes to be nothing more than a summary of the means adopted by the writer as topographical guides to definite portions of the brain, and is not in any sense a review of what has hitherto been written in elucidation of the problem under discussion, although such writings in so far as they have rendered invaluable assistance will be referred to, viz., those by Heffler, Broca, Féré, Lucas, Championnière, Reid, Hare, etc.

The localization of disease of the encephalon is obviously a two-sided process. First, the diagnosis of the seat of the disease in the nerve tissue, by observation of the symptomatic perversion of function; and, secondly, the determination of the particular part of the skull and soft parts covering the focus of disease.

The second part of the process has usually been separated from the first, and considered by itself, under the title of cerebral topography, and may, doubtless, with advantage be thus studied as a distinct subject; but it really is in closer connection with the other division, namely, cerebral localization, than may appear at first sight to the anatomist. The truth of this will be obvious at once upon consideration of the fact that cerebral topography, pure and simple, consists in a determination of the exact relation of the various sulci to the exterior, yielding, of course, invaluable and indispensable results; but, further, that a minute study of localization of function in the cerebrum shows that although these same sulci possess a fundamental value in the separation of areas possessing different functions, that such topographical division is not to be regarded as absolute and definitive. This fact, of course, in no wise militates against the general principles of cerebral localization, and it is, besides, only more specially true of those functions which are very largely represented in the nerve centres.

As an illustration of the truth of this general proposition, we may point to the mode of representation of the upper limb, as recently defined by Dr. Beevor and myself (following upon the lines laid down by Dr. Ferrier), from which it would appear that several and the same segments of the limb are represented in the cortex on both sides of the fissure of Rolando. Indeed, although fortunately the representation of function—*i. e.*, in this case movement—is exceedingly constant and clearly defined,

yet the delimiting value of the various sulci has still to be determined, it being perfectly clear from the observation of examples, such as that just quoted, that mere physical characteristics, such as length, depth, etc., of a sulcus, heighten its value, not as a *boundary*, but as a *landmark* of function. In this way we shall subsequently find that, while always having to start an attempt to localize disease, by first determining the relative positions of the different sulci, the completion of the inquiry will only be accomplished by application of the knowledge of the concentration of the representation of any given function about certain points in those sulci.

It consequently follows that the localities in which different functions are represented are not separated by hard outlines (and this belief is also borne out by experiment), but that they occupy absolutely constant focal positions, and in this way will in the, let us hope, immediate future be very accurately mapped out. The above considerations also bring us back to the point we started from, viz., the close union of the representation of function and the topographical positions of the sulci, for the mapping out of the localities of function is only to be done by the accurate observation of experiments on the lower animals, and by the very rare opportunities of clinical observation in cases of very closely delimited disease.

The last-named method, viz., clinical observation of the effects of disease, furnishes but barren results, as may be seen, for instance, from the exceedingly slight advance which has been made by its means in our general knowledge of the pathology of new growths. On the other hand, the determination of the representation of cerebral function by means of experiments upon the brains of animals closely allied to man, has proved most fertile in the production of facts upon which very active treatment has been safely based. Indeed, we owe nearly all we know about the function of the different parts of the cortex cerebri to experiments upon the lower animals.

Fortunately, it is easy to establish the exact homologies between the parts possessing certain functions in the brains of the higher monkeys, and the like parts in the brains of men. The identity of the various localities of function is readily determined, and, speaking from the evidence at our present disposal, is fairly complete.

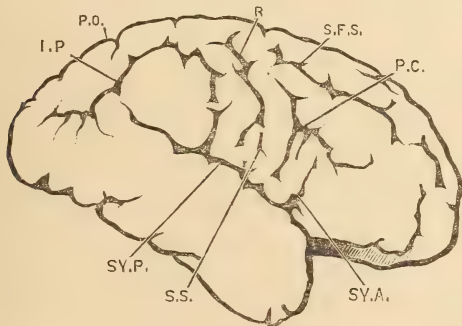
LOCALIZATION IN THE CEREBRUM OF THE FUNCTION OF MOVEMENT OF DIFFERENT PARTS OF THE BODY.

The localization of the special sense functions in the human cortex cerebri is still a matter of such contention as regards minute detail that it would be unpractical to devote any part of the present paper to its consideration, and especially as from lack of immediate personal experi-

ence, all that could here be said on the point would be little more than a mere digest of monographs and collected works available to all neurologists. Such a digest, it need hardly be added, is altogether outside the original scope of this note. Limiting ourselves, therefore, to the subject of the representation of the function of movement, we will proceed at once to sketch the position of the various localities of such representation, according as they are known at the present day, bearing in mind the outlines and nomenclature of the sulci and gyri of the centre of the brain.

It would also be foreign to the subject of this paper if it included a very full description of the well-known anatomical details of the configuration, etc., of the cortex of the brain; but many important details must be referred to, and, for the sake of completeness of illustration and by way of preface, the reader is referred to the accompanying diagram, Fig. 1, which is traced from a photograph of the right hemisphere of an

FIG. 1.



P. O. Parieto-occipital fissure (external).

I. P. Intraparietal sulcus.

R. Fissure of Rolando.

S. F. S. Superior frontal sulcus.

P. C. Parietal sulcus.

Sy. A. Anterior limb of the Sylvian fissure.

Sy. P. Posterior limb of the Sylvian fissure.

S. S. Subordinate sulcus separating area of absolute adduction of vocal cords.

adult English woman. It may be advisable, moreover, to point out that, as the representation of one and the same function may extend over and beyond this or that sulcus, as has already been mentioned, it is advantageous mentally to subdivide this region into horizontal levels, for the variation in the representation of function will be found to be greatest in passing over the "motor" area from above down. In other words, the nature of the function of the convolution bordering the longitudinal fissure, is more different from the function of the convolution forming the upper edge of the Sylvian fissure, than is the function

of the anterior third of the so-called motor region from the posterior third.

We may say, therefore, with perfect anatomical truth, that this great variation in representation from above down, and the slighter difference from before back, is correlated with the decrease in the size of the so-called motor corpuscles from the paracentral lobule downward, and their comparative constancy in volume in one and the same horizontal level.

It will thus be found convenient to conceive of the convex region, known popularly as the "motor area," as being subdivided nearly horizontally by imaginary extension backward of the superior and inferior frontal sulci, and of these levels again as interrupted by subdivisions, often of a very arbitrary but useful character. For instance, a line drawn forward from the lower end of the intraparietal sulcus and parallel to the fissure of Sylvius, will be found to mark very distinctly the division between the representation of movements of the upper limb and of the face behind the fissure of Rolando. A digression may be made here for the purpose of strengthening what has just been said, by pointing out, as may be easily done from the facts of comparative anatomy, that the fissure of Rolando as a sulcus which is transverse to the long axis of the hemisphere, is an intruder, disturbing the harmony of the longitudinal folding of the cortex into gyri, which is so characteristic of the convoluted cortex of the lower animals, and is probably of primal ontogenetic importance. We shall see presently, moreover, that this wide difference of the representation in the upper, as compared with that of the lower parts of the parietal lobe, is not confined to merely the parts of the body that are moved, but that it also determines the nature of the movement itself.

There remains yet another consideration of great general importance and which by reason of its applicability to every variety and degree of so-called motor function must now be discussed and for practical purposes settled in these prefatory remarks. We refer to the closely debated question of the intimate nature of the representation of movement that is to be obtained from any one given portion of the cerebral cortex.

To illustrate: If the electrodes of an induction coil be applied to the so-called motor cortex of a monkey, just above the lower end of the intraparietal sulcus, there will result the simple movement of flexion with adduction of the thumb—that is, practically speaking, movement in only one or at the most two segments of the limb; whereas, if the current be applied above the hinder end of the superior frontal sulcus, there will occur synchronous movement of all the segments of the lower limb and of one or two of the upper limb, the current in both this and the preceding instance being only of just sufficient strength to evoke movement. In these two cases it is obvious that the "nature" of the move-

ments evoked by exactly the same means is completely different; the difference consisting both in the extent of the body moved as well as in the kind of movement produced. If now this simple effect of what may with justice be termed a minimal stimulation (Beevor and myself) be further complicated by increase in the force of excitation or in the proneness of neighboring centres to become involved in the act of discharge, we find movement is generated thereby in those parts of the body which lie next in serial order to the parts which were moved by the minimal stimulation. The movement produced by minimal stimulation has been termed, by Dr. Beevor and myself, the primary movement represented in that part,¹ and the subsequent additional movements as secondary. The existence of the experimental fact of the primary movement and the close correlation of neighboring parts is unquestionable, but it naturally affords material for divergence of opinion in its interpretation, and seems to the writer to suggest the following view of the manner in which movements are represented in the "motor" cortex.

Thus we are justified in believing that in any given part of the cortex, as minute as can be examined experimentally, there is represented a definite movement or combination of movements of a definite segment or segments of one or both of the opposite limbs; such movements or combination of movements being the primary movement as defined by Dr. Beevor and myself, and being elicited, be it remembered, by minimal stimulation only. Further, that secondary movements are due to the subsequent invasion by the discharge of nerve energy of those portions of the cortex which lie nearest to and are in close relation to the parts stimulated.

Such a view, of course, connotes that of the existence of a close commissural connection of one centre with another, and more than that, of the overlapping of the borders of such centres, or, in other words, the commingling of neighboring representations of movement.

The old opposition against the grand truths of cerebral localization, rested upon the gratuitous assumption that a demonstration of the representation of single movements of single muscles was necessary to the establishment of the accuracy of the theory. And this species of criticism continued to exist even after the crushing demonstration by Dr. Hughlings Jackson, that representation of function in this portion (his "middle level") of the central nervous system meant representation of movements, and not of muscles, and, indeed, it may still exist in the minds of some of those who forget that it is impossible for us to contract purposively one single muscle in the body.

To sum up the foregoing: in seeking for the most profitable utilization of the facts, plentifully derived from experiment and scantily from

¹ For the introduction of these terms Dr. Beevor and myself are responsible, and details of the work upon which they were based will be found in the *Proc. of the Roy. Soc.*, 1886, and *Phil. Trans.*, 1887.

clinical observation, for determining the situation of localities of definite function (motor only, be it remembered), it is clear that we must first picture to ourselves very distinctly the extent of cortex in which definite segments of the body are represented, and then to define similarly the areas in which the various given movements are represented.

This must now be done with the help of diagrams, it being distinctly understood that the lines limiting the areas of representation either of segments or of movements are purely provisional, though founded upon the experiments of Dr. Ferrier, Professor Schäfer and myself, Dr. Beevor and myself, and also on my cases of operation on man. To be strictly accurate, judgment respecting such limitation of "centres" must obviously be restricted until our knowledge of the degree of representation in man is fully ascertained.

I. THE TOPOGRAPHICAL RELATIONS OF THE SO-CALLED MOTOR REGION TO THE EXTERIOR OF THE SKULL.

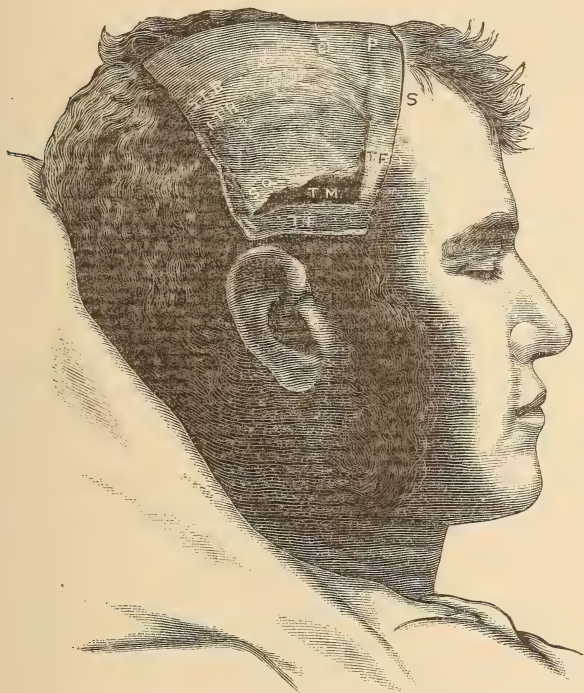
In accordance with the object of this paper, it will now be best to describe the surface markings of the portion of the head inclosing the parts of the brain under discussion. There can be little doubt that the risk of topographical error increases in measuring from below upward;—*i. e.*, in mapping out the convexity of the calvaria by lines drawn upward from a line carried along the side of the base of the skull. It behooves us, therefore, to seek for means of measuring the position of the vertex parts of the brain from fixed points in the middle line.

The sutures (*vide* Fig. 2) occupy, of course, the foremost position among the *points d'appui* of topography. They need no description here, neither is any detail required of the other landmarks on the vertex beyond a few passing notes. Next to the sutures in importance come the eminences, and the so-called motor region is limited, roughly speaking, in front by the frontal eminence and posteriorly by the parietal eminence. As regards these eminences, it is easy to determine by taking antero-posterior and supero-inferior views of the skull from a short distance, the centre point of the elevation in each case, and this spot is known for topographical purposes as the eminence itself, though the descriptive anatomist would also include the sloping sides of the elevation. This wider view, of course, is useless for our present purpose, since it in no wise defines the limits of the eminences.

Next to the eminences, of course, will come in value the temporal ridges. These consist, and this can be verified on almost any skull, of two well-marked lines, the lower of which has alone been noticed till recently. This lower one is the more strongly marked, it is continued upward from the external angular process of the frontal bone, limiting anteriorly and superiorly the deep hollow of the front half of the temple

fossa and following a semi-circular course along the lower part of the parietal bone till it is lost just above the attachment of the pinna. The point where it crosses the coronal suture was more conveniently and

FIG. 2.



This figure, from a photograph, shows the head of a cadaver from which the scalp has been removed opposite the so-called motor region of the brain. For this photograph and that of Fig. 3, I am very greatly indebted to my friend Dr. Wilson, Senior Resident Physician to the National Hospital for the Paralyzed and Epileptic, who prepared them from my directions under circumstances of inconvenience and special difficulty.

S. Edge of cut scalp.

P. Pericranium.

C. Coronal suture.

S. T. R. Ridge of temporal fascia,
or superior temporal ridge.

I. T. R. Ridge of temporal muscle,
or inferior temporal ridge.

S. Q. Squamous-parietal suture.

T. M. Temporal muscle.

T. F. Temporal fascia.

appropriately termed by Broca the stephanion. This temporal ridge marks the upper border of the attachment of the temporal muscle. Above it runs a second ridge or line also commencing anteriorly at the angular process of the frontal bone, but soon leaving the lower temporal ridge, until opposite the middle of the lower border of the parietal bone it is, as a rule, fully one centimetre above that of the temporal muscle. The uppermost ridge marks the attachment of the temporal fascia, and, it may be added, the periosteum covering the bone of the vertex and

lower down beneath the muscle is more firmly attached to the temporal ridges than elsewhere. These two ridges might be advantageously known as the ridge of the temporal muscle and fascia respectively (*vide* Fig. 2). All these points can be made out on the living subject and with greater ease, of course, if the head be shaved. The only difficulties met with are in the determination of the coronal suture and the temporal ridges.

The coronal suture can be readily made out in most cases by steadily pressing the scalp with the thumb backward and forward over its supposed site. With a little practice the dentations can be detected, especially just above the stephanion. The bregma being easily defined by measurement or otherwise, the upper third of the coronal suture, which is usually very difficult to feel, can be filled in by continuing upward the line of the lower part discovered by palpation. We shall see, presently, that the determination of the coronal suture is of extreme importance.

The ridge of the temporal muscle can be most readily determined by telling the patient to shut the mouth very firmly: the temporal muscle will then stand out in relief and the outline of its upper margin becomes very marked. In the majority of instances the ridge of the temporal fascia can be felt by palpation. If not, it can be detected as being the first point at which the sloping bones of the roof of the skull become vertical to form the side walls.

In some instances the coronal suture cannot be detected by palpation, but in its neighborhood there can be felt a rounded ridge which is bounded posteriorly by a distinct though shallow groove occupying the anterior sixth of the parietal bone, while a similar but less marked groove exists on the frontal bone in front of the ridge bearing the suture. The finger thus starting from the parietal eminence would, if carried forward, first gradually pass down into the above-mentioned groove, then would leave that crossing the ridge containing the suture and lose itself in the shallow groove on the frontal bone in front of the suture.

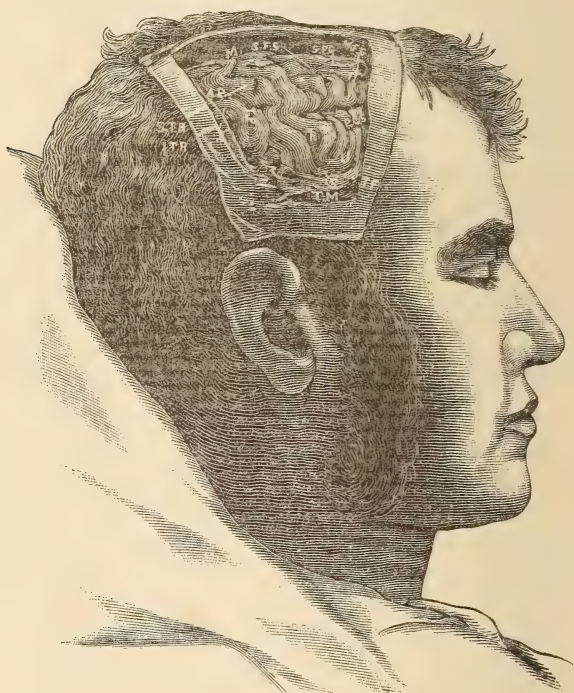
There is one line of suture of which no mention has yet been made, which is at the same time perhaps more important than the other, viz., the parieto-squamal (*cf.* Figs. 2 and 3). This semicircular suture is, of course, buried beneath the muscle in the temporal fossa, and attains its greatest height in a vertical line drawn in front of the articulation of the lower jaw, being at this point at about the junction of the upper and middle thirds of the distance between the ridge of the temporal muscle and the upper border of the zygoma. The H-shaped junction of the parietal, great wing of the sphenoid, the frontal, and squamous bones, marking as it does the divergence of the branches of the Sylvian fissure, was termed the pterion by Broca, and forms the commencement of the squamous suture.

The external relations of the pterion are, of course, also obscured by its being covered by the temporal muscle, but the sloping transverse (*i. e.*, antero-posteriorly directed) bar of the H indicating the sutural union between the anterior inferior angle of the parietal and the upper and posterior border of the great wing of the sphenoid is situated, generally speaking (*i. e.*, for English adults) half way between the stephanion and the upper border of the zygoma, the measurement being taken along a line drawn vertically to the zygoma from the stephanion.

THE RELATION OF THE CONVOLUTIONS OF THE "MOTOR" AREA TO THE PROMINENCES ON THE SKULL JUST DESCRIBED.—The first fissure of these regions to be determined in position is that of Rolando (*vide* Fig. 3). Hitherto this has been sought for by erecting verticals from a horizontal base line drawn through the external auditory meatus; but these lines, even with the aid of the instrument of Lucas-Championnière and others, are liable to error, from which it is believed the method now to be described is comparatively free. The better plan is first to adopt the method devised by Professor Thane, of University College, London, for locating the upper end of the fissure of Rolando. His plan is to take the length of the middle line of the head from the root of the nose—*i. e.*, the glabella—to the occipital protuberance or inion and then by halving the result to obtain the centre of the middle line of the head. The upper end of the fissure of Rolando will be found in adults to be situated half an inch behind this centre-point of the head. The only possible objection to this rule can be that the definite expression is introduced in terms of inches. But from numerous observations by Professor Thane and the writer this slight drawback has been found to have no practical importance whatever. In very many cases the spot indicated by this plan will be found to be exactly the upper end of the fissure. Given the commencement of a fissure at its highest point so correctly, it is obvious that if its direction is at all constant its exact position must be easily discoverable and determined. This is the case. Dr. Hare, of Edinburgh, has shown that the angle which the fissure makes with the middle line is very fairly constant. The extremes determined by him did not vary more than a few degrees and the mean of his measurements was sixty-seven degrees. To facilitate the clinical combination of the foregoing facts, I have caused to be constructed a very simple instrument of soft iron (nickelized) consisting of a long (10 inch) strip one centimetre broad, from the middle of which branches off another strip (about 6 inches long), the two making an angle anteriorly of sixty-seven degrees. On the short arm is marked on both sides a scale of inches commencing half an inch from the middle line. This instrument is used thus: The long arm is laid upon the middle line of the head which has been previously marked; the angle between the arms is then made to coincide with the theoretical situation (Thane) of the upper end of

the fissure of Rolando; a line drawn down the anterior border of the short arm will now give the situation of the fissure perfectly accurately for the upper two-thirds of its course. The fissure of Rolando, however, is not a perfectly straight line. Both in the monkey (as observed by Beevor, myself, and Hare) and in man, the fissure runs downward and

FIG. 3.



View of the same head as Fig. 2. The base being removed by a vertical saw-cut through the stephanion (inferior), by another along the squamo-parietal suture, by one parallel to the fissure of Rolando and just in front of the parietal eminence, and by one along the outer border of the sagittal suture.

- | | |
|---|--|
| M. Margin of the hemisphere. | R. Fissure of Rolando. |
| S. F. S. Superior frontal sulcus. | S. Fissure of Sylvius. |
| S. F. G. Superior frontal gyrus. | T. M. Temporal muscle. |
| M. F. G. Middle frontal gyrus. | T. F. Temporal fascia. |
| P. C. S. Precentral or vertical sulcus. | S. T. R. Superior temporal ridge. |
| A. F. Ascending frontal gyrus. | I. T. R. Inferior temporal ridge. |
| A. P. Ascending parietal gyrus. | U. Subordinate sulcus in ascending frontal gyrus |
| I. P. Intraparietal sulcus. | which unites the phonatory centre. |

forward, but when about opposite the lower end of the intraparietal sulcus it becomes directed more vertically as it approaches the Sylvian fissure. It thus forms a slight knee at this part of its course. Both in the higher and lower animals the amount of the flexure of the fissure varies slightly but distinctly in different individuals. For this reason, although the lower end of the fissure does not vary more than a quarter

of an inch in a horizontal plane, no line, more or less vertical, can determine it accurately. Nor is one necessary, as we shall see directly.

The next fissure to be considered is the fissure of Sylvius, consisting as it does of a short anterior and long posterior branch, and forming the inferior and to a slight extent the anterior limit of the "motor" region.

It has already been seen that the Sylvian fissure commences at the pterion, the anterior branch running upward and forward continuing, as it were, the line of the sphenoido-squamous suture but commencing one or two millimetres in front of it. The posterior branch passes upward and backward just above (on the average, one-half of a millimetre) the squamo-parietal suture as far as its highest point, and there leaving it continues by curving slightly upward toward the centre of the parietal eminence, which it nearly reaches.

By reason of the fact that this extremely important fissure gives off no branches save of a very subordinate character, and since it is so easy to localize its position, little more need be said here than to emphasize the fact that the anterior branch just in front of the lower end of the coronal suture limits the so-called motor region anteriorly, while the posterior branch, just below which lies the squamo-parietal suture, bounds the region inferiorly.

The pre-central or vertical sulcus, is the next important cortical landmark to be studied. This sulcus (not a fissure, there being only five fissures in the brain, viz., the longitudinal fissure, the Sylvian, the Rolandic, the parieto-occipital, and the great transverse fissure of Bichat), unlike the fissure of Rolando, runs parallel to and just behind the coronal suture. It is of extreme importance, as we shall see, since it divides two convolutions of very different functions, and because it has on either side of it convolutions in which most extensive representation of movement exists. Following the coronal suture, it then runs upward and slightly backward, so that when a tangent to the bregma is in a horizontal plane it does occupy a very vertical position, hence its second but inferior name of "vertical" (*vide* ascending frontal convolution *infra*). This pre-central sulcus, as a rule, reaches to about the centre of the fissure of Rolando, and from it diverges forward the inferior frontal sulcus about opposite the superior temporal ridge. The point named by Broca, the stephanion, should also be applied to the point where the superior temporal ridge crosses the coronal suture, and then we may speak of the superior and inferior stephanion. In some skulls these two are practically almost identical, owing to variations in the attachment of the temporal fascia and muscle respectively. Above the point of origin of the inferior frontal sulcus, the pre-central sulcus continues half way across the root of the middle frontal convolution. The localization of the upper part of the pre-central sulcus is, therefore, an easy matter, and further, the convolution passing around its lower end, and separating it

from the Sylvian fissure, is very frequently of the same breadth, viz., about one centimetre, which may *practically* be regarded as constant.

It will be best now to consider the topographical value of the superior frontal sulcus. This usually fairly constant sulcus commences in the ascending frontal convolution about midway between the fissure of Rolando and a line continued upward in the line of the pre-central sulcus. Its commencement, a short upward sloping furrow, is thus well behind the latter sulcus, and is readily determinable on the skull after the positions of the fissure of Rolando and coronal suture have been defined. Both superior and inferior frontal sulci run forward and slightly downward, being for the most part parallel to the longitudinal fissure, and much complicated by the presence of many secondary branches. The rest of the frontal division of the so-called "motor" region, we shall return to in speaking of the convolutions, but it cannot be too clearly understood that this is the most important part of the excitable area of the cortex.

Behind the fissure of Rolando lies the intraparietal sulcus. This sulcus is noteworthy as forming a well-defined posterior limit to the "motor" region. It can be discovered externally by first localizing the position of the fissures of Rolando and Sylvius, and although it gives off no branches beyond very subordinate ones, it passes from the parietal lobe into the occipital, and thus limits most accurately the posterior border of the "motor region." Its commencement at its lower end has been before referred to as being opposite the knee-like bend in the fissure of Rolando. As it passes upward it very soon tends to leave the fissure of Rolando, and thus forms the ascending parietal convolution, the summit of which is so widened as to receive the name of a lobule, namely, the superior parietal lobule. To this we shall presently return, as its topographical determination externally is extremely important. The intraparietal sulcus turns directly backward, below the horizontal level of the superior frontal sulcus, and it gradually comes to run more or less parallel to the longitudinal fissure, passing round the outer end of the external parieto-occipital fissure (which, probably in man, forms the posterior limit of the vertex border of the "motor" region), and terminates in the occipital lobe. In the first part of its course, while forming the posterior border of the ascending parietal convolution, the sulcus lies (externally) midway between the line of the fissure of Rolando and the centre of the parietal eminence. Further up, as it passes backward, it lies midway¹ between the longitudinal fissure and the centre of the parietal eminence. It is thus easily determined.

The parieto-occipital fissure may be briefly referred to in this connec-

¹ The commonest line (*i. e.*, form) of the intraparietal sulcus has yet to be determined, and the real breadth of the ascending parietal gyrus consequently remains unknown also. The line of the intraparietal sulcus may, in many instances, pass closer to the parietal eminence than is stated above.

tion, but this must be more by way of completeness of description than from absolute knowledge whether it really does form a landmark of representation of movement in the cortex of the human brain. It is a small fissure, rarely more than an inch in length in the adult; it is directed outward and slightly forward, thus nearly at right angles to the longitudinal fissure (into which it opens), and it lies almost invariably just in front of the apex of the lambdoid suture (usually two to three millimetres in front of that point).

The first half of the description of the relations between the "motor" cortex and the skull being thus completed by the study of the sulci, it remains to consider briefly the convolutions formed by them. And since the size and proportions of the convolutions are absolutely dependent on the distribution and state of the sulci, little remains to be added to what has been said above, save in the way of general statements in especial reference to the various centres of representation which are contained in each, and in noting at the same time the presence of those secondary sulci which appear to have a power of restricting¹ the areas of representation.

The first convolution of greatest importance is the ascending frontal. Beginning with its base or foot, which we have just seen to be covered by the anterior inferior angle of the parietal bone, we must first point out that, unfortunately, there prevails some indefiniteness concerning the terminology of this important spct. Thus the gyrus which separates the lower extremity of the fissure of Rolando from the fissure of Sylvius, was named by Broca the operculum, but apart from the fact that Gratiolet had already appropriated this expression to denominate the posterior border of the external parieto-occipital fissure in monkeys, it was obviously highly undesirable thus to name specially a small portion of brain surface which could not be accurately delimited. Moreover, the introduction of the term was superfluous, since owing to the fortunately very distinctly vertical direction of all the principal sulci about this spot, there is no difficulty whatever in marking off the foot of the ascending frontal convolution by simply mentally prolonging the fissure of Rolando posteriorly and the pre-central sulcus anteriorly into the fissure of Sylvius.

And, of course, at the same time we are as distinctly defining the foot of the ascending parietal on the one hand and the hinder end of the inferior frontal convolution on the other.

To return now to the ascending frontal, we note that in man the foot of this convolution is sometimes narrow, unlike the homologous structure

¹ In speaking thus of a sulcus restricting representation of (motor) function it must be here stated that excitation by faradism of the walls or bottom of a sulcus evokes no movement, and further that, as is well known, the large "motor" corpuscles of the fourth layer are not found in the walls deeper than the depth of the cortex, measuring perpendicularly to the surface of the hemisphere.

in monkeys, a very suggestive difference. Although it may be narrow, this foot constantly presents a partial division by a vertical subordinate sulcus (s. s. Fig. 1), and this is always present in the monkey, in which animal it has a very decided significance (*vide* page 357). Opposite the hinder end of the middle frontal convolution the gyrus attains its greatest breadth, and narrows again very markedly opposite the hinder end of the superior frontal sulcus, this narrowing also conditioning, or rather coinciding with a difference in representation of function. Above, the gyrus terminates in the marginal convolution.

Unlike the two great central gyri, the frontal convolutions present numerous subordinate sulci. They decrease in vertical breadth from below upward. The inferior frontal gyrus is broader posteriorly where the movement of the head and eyes is represented, and without entering into a discussion as to what is causative of the greater breadth of the base of the frontal lobe as compared with its anterior extremity, we may note that the vertical width of the hinder end of the inferior frontal convolution is correlated with the upward direction of the anterior limb of the fissure of Sylvius, which may figuratively be regarded as pushing the gyrus upward. (*Vide* Figs. 1 and 2.)

The middle frontal convolution preserves its breadth fairly constantly, but we have nothing to do in the present paper with the consideration of the architectural arrangement of the forepart of the frontal lobe, since that, so far as we know, is not "motor," if efferent in function.

The hinder end of the superior frontal convolution is limited posteriorly by an imaginary line drawn from the hinder end of the superior frontal sulcus to the longitudinal fissure, and parallel to the fissure of Rolando. The external relations of these parts have been already dwelt upon, and it only remains, therefore, to state that this gyrus also, like the next, though narrower, is of fairly constant breadth, lying parallel to the longitudinal fissure.

It will be remembered that the superior longitudinal sinus lies just to the right of the middle line, so that its left border is almost coincident with the exact medial line of the head. It thus necessarily follows that the inner border of the right hemisphere will lie, as a rule, just outside of the line joining the ends of the widest denticulations of the sagittal suture: while, on the other hand, the margin of the left hemisphere will border closely on the middle line.

The ascending parietal convolution is neatly marked out by the intraparietal sulcus behind, and the fissure of Rolando in front. Soon after it has passed the genu of the latter fissure it widens to form the superior parietal lobule, as before mentioned, and by reason of its continuing posteriorly with the occipital lobe around the outer end of the parietal occipital fissure, it is not surprising to find that the part termed this lobule is divided by subordinate sulci. In the monkey there is a small

and subordinate, but remarkably constant sulcus, on a level with the superior frontal, which marks off a small portion of the gyrus anteriorly. This sulcus is always present in man, and according to the degree that it is developed the parietal lobule varies in shape. The exact arrangement of the sulci here requires further attention.

It is, of course, at present impossible to divide the lower margin of the parietal lobule from the rest of the convolution, but it is to be hoped that localization will clear up this problem in man ere long.

MESIAL SURFACE.—The only part of the mesial surface which concerns us at this present time is the marginal convolution, or, more strictly speaking, its posterior half, the paracentral lobule being included in the same. The external topographical anatomy of this gyrus is, of course, simply that of the border of the hemisphere mentioned above.

II. THE ENUMERATION AND LIMITATION OF THE AREAS OF REPRESENTATION OF THE DIFFERENT PARTS OF THE BODY IN THE GYRI THUS TOPOGRAPHICALLY DETERMINED.

We are now in a position to set before ourselves the quality and extent of the representation of the various parts of the body in this so-called motor region, and so, knowing where each primary (see page 347) movement is represented, we shall be able, with the aid of the topographical facts just detailed, to picture to ourselves the seat of a lesion which has revealed itself by evoking or paralyzing that particular movement.

In discussing the manner in which we propose to regard the functional arrangement of the convolutions, reason was shown (page 345) for figuring to the mind a horizontal division of this region of the brain; and in treating of the exact localization of function in these parts we shall adopt these views as of great assistance.

We may well begin the consideration of the extent and nature of the movements represented in this region with those of the face and throat. If a line (referred to before) be drawn through the lower end of the intraparietal sulcus and through the genu of the fissure of Rolando, thus cutting off the bases of the ascending convolutions, it will indicate with perfect accuracy the region in which the facial movements blend with those of the upper limb. The representation of the movements of the face and throat extends from the line just mentioned superiorly to the Sylvian fissure inferiorly, and from the pre-central sulcus with its theoretical inferior continuation anteriorly, and the theoretical extension of the intraparietal sulcus to the Sylvian fissure posteriorly. The exact details of the representation of the movements of the face and throat have not yet been thoroughly investigated experimentally, nor (as might have been anticipated) has clinical observation filled up the blank.

Several points have, however, been made fairly clear by the work of Dr. Ferrier, Professor Schäfer, and myself, and Dr. Semon and myself. Further, in one case of exploratory operation (Case V.) in this region the writer applied the faradic current (one litre bichromate cell, Du Bois Reymond induction coil, and platinum electrodes) to the surface of the cortex with the view of determining the limitation of the representation of the region of the face, the object of the operation being to excise this area. The electrodes were applied at a spot in the foot of the ascending frontal

FIG. 4.



Representation of the upper face and angle of the mouth.

convolution, at that point which is the junction of the middle and upper thirds of the facial area, the effect of the stimulation being the production of movement of the jaw toward the left, and of the left angle of the mouth.¹ It is in the upper part (*vide* Fig. 4) of the facial area that the

FIG. 5.



Representation of the vocal cords (adduction).

movements of the opposite angle of the mouth, etc., viz., all the groups of muscles being involved which make up what is clinically known as

¹ This spot was clearly the seat of blending of the contiguous borders of the facial areas shown in Figs. 4 and 6.

the lower face, are represented. The remainder of the region for the movements of the face may be conveniently divided into thirds. The anterior third (*vide* Fig. 5), according to the investigations of Dr. Semon and myself, being the seat of representation of the movement of complete adduction of the vocal cords, together with associated movements of other parts of the throat. The hinder two-thirds (*vide* Fig. 6)

FIG. 6.



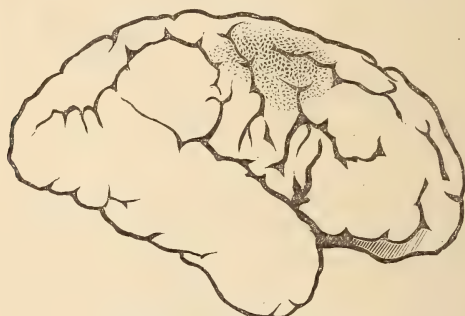
Representation of the lower face and floor of the mouth.

of the lower portion of the facial region is the seat of the representation of opening and shutting movements of the mouth with protrusion and retraction of the tongue and the floor of the mouth (Ferrier, Schäfer, and myself). In accordance with what has been said before, it is to be clearly understood that the areas of representation of these movements are functionally concentrated in the parts of the facial region indicated, but that each blends with the areas surrounding it, there being no sharp line of demarcation between them.

The next area in topographical order is that for the upper limb. The movements of the upper limb are so highly specialized in monkeys and in man as to occupy an extensive area of cortex in their representation, thus the movement in the upper limb—*i. e.*, of one segment of it or another can be elicited by irritating any part of either of the ascending convolutions from the line just mentioned as limiting the upper border of the facial region to a line continuing backward in the direction of the superior frontal sulcus. And yet the representation of the upper limb does not stop here, for it is continued over the superior frontal sulcus into the superior frontal convolution, though here, as we shall later see, every movement of it,—*i. e.*, the upper limb—is synchronously accompanied by contraction of the lower limb. Anteriorly, the upper limb region extends into the middle frontal gyrus for about its posterior fourth; the anterior half of this forward extension being also blended with the representation of the head and neck.

Now this very extensive and important area has recently been analyzed in minute detail by Dr. Beevor and the writer,¹ and what has just been stated is the embodiment of the results thus obtained. And in thus summarizing the details, it may be expedient to call to mind that the object of the present paper is simply to show clearly which parts of the limbs are most represented in which parts of the area; or, to use more popular language, to demonstrate which are the "centres" of the movements of those parts. The nature of the differences of the movement of such parts, though extremely important, is yet subordinate to the question of the *primary* representation of the parts moved when the practical needs of the diagnostician are considered. The first thing to be done, therefore, is to show the degree to which the various segments of the limb are represented in the area.

FIG. 7.



Representation of the shoulder.

FIG. 8.



Representation of the elbow and wrist.

Most briefly the distribution of the parts amounts to this: the shoulder is centred in the upper part of the area, the elbow next below and pos-

¹ Proc. Roy. Soc., 1886.

teriorly, the wrist next below and anteriorly, the fingers next below and anteriorly, the thumb lowest and posteriorly. In other words, the pri-

FIG. 9.



Representation of the thumb.

mary representation of (*vide* Figs. 7, 8, and 9) the various segments of the limb is parallel to their anatomical arrangement—viz., from above downward. But another fundamentally important consideration here intervenes and gives a very definite character to the representation of the upper limb. This is the fact recognized by Dr. Beevor and the writer, that the elbow and wrist are hardly ever the seat of primary movement alone. The wrist is, of course, frequently the seat of primary movement, as may be seen in the accompanying diagram, but the existence of its own primary movement is evidently conditioned by the necessities of the never absent associated movement of the digits. The elbow very rarely ever moved primarily in association with other parts.

Viewing, on the other hand, the *movements* of the limb as a whole, we find that there is hardly one in which the elbow and wrist do not take part. Consequently, we conclude that these central joints are subordinate and that too, to the shoulder on the one hand and to the digits on the other. Finally, we have represented most briefly by (*vide* Figs. 7, 8, and 9) diagrams borrowed from the paper before referred to, the relative degree to which the various joints are represented in the upper limb area; the darkest shading signifying the most intense representation, or, as it would be popularly termed, the centre for the movement of that joint. It is advisable to point out here, that the transference of the results obtained by experimental investigation of the cortex of the monkey's brain, to translate the symptoms arising from irritative lesions in the human cortex, is very exact and reliable. Nor is this to be wondered at, since, as we are all of us aware, the movements of the upper limb in the monkey and in man are nearly identical. Confirmation of the truth of this statement is furnished by three cases of cerebral tumor from which I have successfully removed the growth, localizing the same

by the aid of the rules given in this paper. The situation of the lesion in each case, together with the primary movement elicited by the irritative effect of the same, is given in the accompanying diagrams (*vide* Figs. 10, 11, and 12), the primary movement in these cases meaning, of course, the first tonic spasm in epileptic fits produced by the lesion. In one case (Case IV., Fig. 10) the fits began with flexion of the shoulder, the

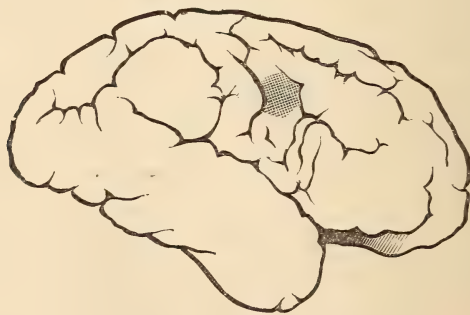
FIG. 10.



Case IV.

remaining segments of the limb being affected in order from above down, while finally the leg and face became affected. At the time of operation there were absolute hemiplegia and coma, both of which were relieved by removal of the tumor, which weighed four ounces and clearly grew in the corona radiata toward the cortex. Full details will shortly be published. In another (Case II., Fig. 11) the fits began in the

FIG. 11.

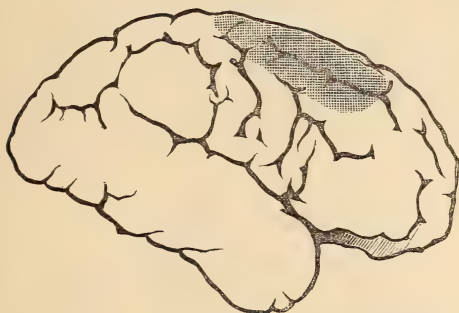


Case II.

thumb. The case is fully described in the *Brit. Med. Journal* for October 10, 1886. In the third a diffuse tumor (Case X., Fig. 12) invaded the shoulder region and caused constant clonic spasm of the shoulder- and elbow-joints, besides severe fits beginning in the shoulder. Full details

will soon be published. The confirmation of the accuracy of the experimental diagnosis really rests, of course, upon the fact of the tumor, etc., being found at the time of operation exactly where it was before determined to be.

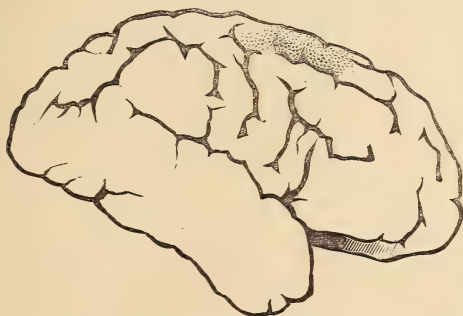
FIG. 12.



Case X.

Leaving now the areas for the upper limb, and crossing therefore the superior frontal sulcus, we come first into a region where the representation of the upper limb and that of the lower limb are absolutely blended. This condition exists most markedly in the hinder sixth of the superior frontal gyrus abutting on the upper end of the ascending frontal (*vide* Fig. 13). This latter portion of cortex, however, really forms an inte-

FIG. 13.



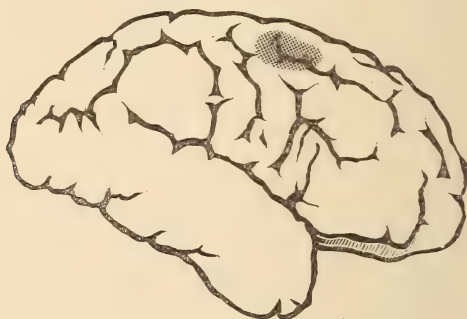
Reproduction of the combined synchronous action of both limbs.

gral part of the lower limb area, especially the same extending back behind the upper end of the fissure of Rolando into the so-called parietal lobule, which is nothing more than the upper part of the ascending parietal gyrus. This area of combined action of the limbs is a very remarkable one. The movement of the upper limb, which, be it remembered, is absolutely synchronous with that of the lower, consists primarily and essentially in what is known to anatomists as flexion of the

shoulder, in which movement the humerus is brought forward in a plane parallel to that of the middle line of the body. Consequent upon this movement of the shoulder the elbow is also extended. The movement represented in this region, according to Dr. Ferrier, *Functions of the Brain*, 2d ed., p. 481, are "various complex movements of the arms and legs, such as are concerned in climbing, swimming," etc.

Dr. Beevor and myself are about to publish a minute analysis of all this region, the function of which is so interesting as well as important. The representation of this combined movement of the limbs is shown in Fig. 13. Further, a case of traumatic epilepsy (Case I.,¹ *vide* Fig. 14),

FIG. 14.



Case I.

in which I freely removed a thick, fleshy, congested scar which penetrated an inch into the substance of the hemisphere, exemplified this localization of function, since the primary movement in the epileptic fit commenced in the complicated manner just indicated, the lesion being situated at and around the hinder end of the superior frontal sulcus.

In a similar case, though not so perfectly limited (Case X., *vide* Fig. 12), in which I removed a four ounce tumor from this same region, a similar primary combined movement of both limbs was observed; additional information for localization purposes, however, being supplied by the fact that more recent involvement of the shoulder area was producing constant clonic spasms of the upper segment of the upper limb.

We may now leave the topographical diagnosis of lesions along the line of the ascending frontal gyrus, except as regards its summit—*i. e.*, immediately in front of the upper end of the fissure of Rolando. Here, as has just been remarked, commences the representation of the lower limb only (*vide* Fig. 15), and the primary movement of this part is that of the hallux. This functional representation is continued over the margin of the hemisphere into the paracentral lobule (Schäfer and the

¹ Vide British Medical Journal, October 10, 1886, for details.

writer), but the especial determination of the representation of the hallux will be fully described in a forthcoming paper by Dr. Beevor and the writer. Meanwhile, as the following case shows, advantage was taken

FIG. 15.

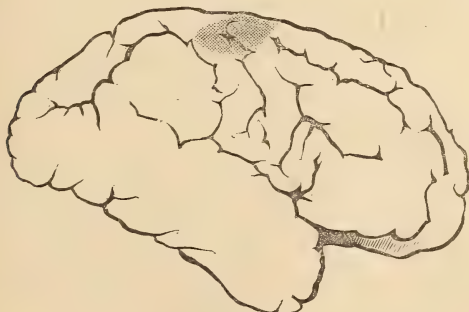


Representation of the lower limb. H. Focus of representation of the hallux (Beevor and writer.)

of the knowledge gained by the incomplete investigation to diagnosticate the situation of a cortical lesion and, as it proved, successfully. I owe the opportunity of seeing and treating the case to the kindness of my friend Dr. Savill, medical superintendent of the Paddington Infirmary.

Case VII., a navvy, was struck on the head with a pair of tongs eight or nine years ago, while intoxicated, no obvious injury save a scalp wound being produced. Traumatic epilepsy resulted, the primary movement consisting in flexion of the hallux followed by the gradual flexion of the rest of the lower limb and that followed by successive invasion of the rest of the body in the usual order. The fits, however, returned with increasing violence and he came under the care of Dr. Savill two years

FIG. 16.



Case VII.

later. When the writer saw the patient the fits were of the same character as heretofore. The skull having been uninjured by the accident, the diagnosis was made of a cicatricial lesion situated (*vide* Fig. 16)

about the upper end of the fissure of Rolando invading the upper end of the ascending frontal gyrus. On freely opening the skull and dura mater a dense and cystic cicatrix was found at this spot and almost completely removed (a small portion had to be left behind in consequence of the patient, an alcoholic subject, collapsing at this stage of the operation, rapid completion of which, however, effected his recovery). Since a week after the operation he has had no further fits. This case illustrates the truth of the representation of the hallux being situated at this point. In a further case twice referred to before (Case X., Fig. 12), recently (five weeks ago) operated upon by the writer, a tumor (also weighing four ounces, see Case IV.) was removed and with it the cortex in front of the upper end of the fissure of Rolando. The only permanent complete paralysis in the lower limb is that of the hallux. The representation of the lower limb only was described by Ferrier as situated in the upper part of the ascending parietal gyrus, the so-called parietal lobule. As just mentioned, the representation of the lower limb was also found by Schäfer and myself to be continued over into the mesial surface of the hemisphere. This very important region and function being the subject of further investigation still incomplete, must now be left in order to complete the discussion of the function of the posterior border of the so-called motor region by glancing, in way of review, at the function of the ascending parietal gyrus, while as has just been stated, the upper portion of the gyrus forms part of the area for the lower limb only. It was found by Dr. Beevor and myself (*Proc. Roy. Soc.*, 1886) that the shoulder (adduction with retraction) was next slightly represented in the superior parietal lobule, viz., in the horizontal line of the superior frontal sulcus continued backward. Further, that the rest of the gyrus as far as the lower end of the intraparietal sulcus was the seat of representation (partly combined) of the elbow and wrist in the upper third—i. e., of the arm area and of the thumb and index in the remainder, together partly with the wrist and elbow except at the lowest point, see Figs. 8 and 9, which was reserved for the movements of the thumb.

We are now left with the consideration only of the representation of the head and neck and eyes.

As indicated by Ferrier, the area of representation of these parts occupied almost solely the middle frontal gyrus, and this, no doubt, is the focus of representation of the movement of the turning of the head and eyes to the opposite side, but a minute analysis (by Dr. Beevor and myself) to be published shortly, will show that a much more extensive representation as indicated in Fig. 17 exists.

It must be left, for the present, an open question as to how far the representation of this important and interesting conjugate movement extends *forward* in the frontal lobe. A definite answer can only be given when the homologies between the sulci and the frontal lobe in the

Macaque monkey and man have been thoroughly determined. That this area of function is continued over the margin of the hemisphere into the marginal convolution, has already been shown by Professor Schäfer and myself. (*Proc. Roy. Soc.*, 1885.)

FIG. 17.



Representation of the head and neck together with conjugate deviation of the eyes

In every instance the head and neck are turned to the opposite side, and in some parts there is produced at the same time or later, conjugate deviation of the eyes.

So far, scarcely any mention has been made of the topography of representation of the other trunk muscles, neither has notice been taken of the movements of the organ of special sense, observed by Dr. Ferrier on exciting those portions of the cortex which he deemed to be the perceptive centres of those special senses. It will be remembered that the scope of this paper does not admit of a discussion of these latter observations.

As regards the trunk muscles, much might be said, but reference for detail is invited to the above mentioned paper in the *Proc. Roy. Soc.*, 1885. It is, however, worth while pointing out, psychologically speaking, that there is scarcely ever performed a highly purposive act by the trunk muscles only. The movements of the trunk are simply subordinate to the purposive movements of the limbs, and consequently we should not be surprised to find, as is the case, how extremely small a portion of the cortex is sufficient for primary representation of this part of the body. An illustrative case of the position in the human brain of the areas we have just been considering, is that of Case III., in which a man had been the victim of traumatic epilepsy for many years due to a small punctured fracture of the vertex of the skull, the said fracture being demonstrated externally by a minute depression three or four millimetres broad. The puncture had caused splintering of the inner table, laceration of the dura mater, and partial destruction of the subjacent cortex, so that at time of operation (eleven years later) there was found a rough ring of bone on

the inner surface of the skull around the centre of the fracture, from which a sharp and corrugated fragment one cm. long by five mm. broad projected downward together with a flap of entangled and torn dura mater into the wall of a small cystic cavity in the cortex just above the junction of the middle and posterior thirds of the superior frontal sulcus. This fairly extensive lesion (*vide* Fig. 18), which was freely removed

FIG. 18.



Case III.

(the result being cure of the epilepsy), was thus situated at the point of meeting of the area for the muscles of the trunk, of the area for raising with protrusion of the upper limb, and of that for turning the head and eyes to the opposite side of the body. The existence of such a lesion was diagnosed from the fact that the course of events in the epileptic fit began with an aura of contraction of the abdominal muscles, this was followed by turning of the head and eyes to the opposite side, and then there occurred the raising of the upper limb. The exemplification of the topographical relations of these centres was thus faithfully demonstrated.

CONCLUSION.

As expressed at the outset, the object of this note was simply to discuss the methods employed by the writer in topographical diagnosis of disease of the so-called "motor" region only of the cortex cerebri, and, consequently, nothing more than a mere *résumé* of the facts which have been found useful to bear in mind has here been attempted.

Indeed, a very considerable branch of the subject of cerebral localization has only been glanced at, namely, the localization of the representation of the various movements of the joints—the representation of flexion and extension respectively, etc. The commencement of the consideration of this division of the subject is contained in the papers by Dr. Beevor and myself, and to these reference must be made, as, owing to the novelty of the facts, only cautious use of them for diagnostic pur-

poses is possible, and for this reason no further examination of this point has been made in this paper.

Perhaps the peculiarly wide interest attaching to the subject itself will be considered an adequate cloak for the bareness with which the said facts have been presented.

THE DIRECT ACTION OF ATROPINE, HOMATROPINE, HYOSCINE, HYOSCYAMINE, AND DATURINE ON THE HEART OF THE DOG, TERRAPIN, AND FROG.

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THE alkaloid "atropia" was discovered about fifty years ago by Mein, Hesse, and Geiger. Since that time a host of experimenters have been engaged in the investigation of the action of this drug.

So difficult and perplexing, however, has been the study of its physiological properties, that more than half a century has elapsed without bringing the question to a final or generally satisfactory issue, notwithstanding the fact that many of the most prominent physiologists of the present day have been more or less engaged in grappling with the problem.

A perusal of the unusually rich literature of the subject, with its numerous controversies, bears, indeed, ample testimony of the great difficulty which the interpretation of even the most simple physiological phenomena may, at times, present, and points out the many dangers of forming erroneous conclusions from apparently the most precise and accurately performed operations. So far as the action of atropia on the heart is concerned, the best authorities still differ in about the following points: (1) That its action may be fully explained by assuming that a paralyzing influence is exerted on the terminal filaments of the pneumogastriCS; (2) that atropia at first stimulates and then paralyzes these filaments; and (3) that it not only paralyzes the terminal filaments of the pneumogastriCS, but also stimulates the vasomotor apparatus of the heart.

From some of my former experiments with atropia on the heart and bloodvessels of cold-blooded animals, I was led to conclusions which differ materially from those which are generally accepted by the majority of authors.

The results thus obtained seemed to point clearly to the fact that both the inhibitory and vasomotor apparatus of the heart became excited under the influence of atropia. The reduced ventricular rate fol-

lowing the increased rate was thought to be the result not only of the beginning of exhaustion of the musculo-motor apparatus from over-stimulation, but also of a still existing excitation of the inhibitory apparatus of the heart. This stage of atropine poisoning, however, is shortly followed by diastolic arrest, especially in warm-blooded animals, and to suppose that the inhibitory nerve-apparatus of the heart is still in a state of excitation immediately before diastolic arrest is produced as a consequence of musculo-motor exhaustion due to previous over-stimulation by atropia, would be equal to assuming that the inhibitory nerve-apparatus had never been paralyzed at any time before the death of the whole heart, but, on the contrary, continued in an excited state until the last; in other words, the normal influence of the inhibitory nerve-apparatus over the heart's action is merely inhibited by the over-excited condition of the musculo-motor apparatus and continues inhibited until the latter shows signs of exhaustion.

This view of the subject being clearly opposed to most of the at present received opinions, and the best authorities still differing greatly among themselves, it was our purpose to extend and enlarge the then limited material from which these conclusions had been drawn, and investigate the action of the entire atropine group on the heart of both cold- and warm-blooded animals. It is hoped that the results of these investigations may prove to be a useful addition to our knowledge of the physiological properties of atropine and its allies, not only on the heart but also with regard to its general action.

The method which was employed in experimenting on the frog and terrapin having already been given in detail in some of the previous papers published in this journal, I need here only mention the various steps for the successful isolation of the mammalian heart according to Martin's method, at the same time referring those more especially interested to the more detailed account published by Prof. Martin himself in the *Transactions of the Royal Society*, Part ii., 1883.

ISOLATION OF THE HEART OF THE DOG.—The animal having been placed under the influence of morphia, is fastened to a dog-holder, tracheotomy is performed and a canula introduced into the trachea. The external jugular vein is then dissected out and a canula filled with normal salt solution introduced with its open end pointing toward the heart. Through the latter canula about half a drachm of a one per cent. solution of curare is injected, after which injection artificial respiration is commenced. The vagi are now found and carefully divided. Canulas are introduced into the cardiac end of both common carotids, the arteries being clamped on the cardiac sides of the canulæ. The first two pairs of costal cartilages are now cut away together with the small piece of sternum which they embrace. Then the two internal mammary arteries are ligated just as they pass forward from the subclavians toward the breast-bone. The whole front and sides of the thorax are now cut

away and the right subclavian artery dissected out and tied just above the point where it separated from the common carotid. The superior vena cava is next prepared and a ligature placed loosely around the vessel for subsequently occluding it and tying a canula into its cardiac end.

Proceeding now to the left side of the chest, the subclavian artery of that side is ligated, and, the left lung being gently held aside, the arch of the aorta is isolated and cleared just beyond the origin of the left subclavian; a strong ligature is placed loosely around the vessel ready to be tightened. The azygos vein is next tied, and a ligature placed loosely around the inferior vena cava just as it appears above the diaphragm. Finally, a canula, previously filled with warm blood, is tied into the cardiac end of the superior vena cava, and the animal is prepared to be transferred into the warm, moist chamber in which it is to remain during the experiment.

The canula in the superior vena cava is at once connected with the common outflow-tube of several Mariotte's flasks, which contain the blood of proper temperature intended to feed the heart. The clamps are removed from the carotids, their canulas connected with the outflow-tube, which communicates with a mercury manometer writing on a continuous paper roll. The ligatures, which were but loosely placed around the aorta and inferior vena cava, are now tightened; the heart is washed out for a few moments with the blood from the Mariotte's flask until it is free from clots, and at last the outflow-tube is adjusted so as to secure the proper pressure for the normal working of the organ. The temperature of the circulating fluid may be read off at any time from the thermometer placed into the common outflow-tube.

The remainder of the apparatus consists in a warm, moist chamber, which must be large enough to accommodate the animal on the holder as well as the feeding flasks. The supplying flasks stand on a platform which can be raised or lowered according to the requirements of the particular case. The height of the bottom of the outflow-tube above the heart of the animal is referred to in the experiments as the venous pressure. This pressure, after once being adjusted, generally remains uniform throughout an experiment, and is the same for all the flasks. The outflow-tube, which is connected with the two common carotids, and from the end of which the blood pumped around flows out, and may be measured at stated intervals, is raised to a height which is deemed sufficient to maintain a normal pressure in the coronary arteries. Everything being in readiness, observations are begun a few minutes after the heart has performed normal work.

The drugs which were employed in these investigations came from the firm of Parke, Davis & Co., of Detroit, Mich. Hyoscyamine, hyoscine hydrobromate, and daturine were manufactured by the firm; the sul-

phate of atropine and homatropine hydrobromate had been obtained from Merck's establishment.

ATROPINE GROUP.—Chemically speaking, the remedies belonging to the atropine group, so-called, as atropine, daturine, hyoscyamine, and hyoscyne, are probably all identical. Of late their chemical composition has been investigated more especially by Ladenburg, whose researches, however, according to Harnack,¹ have not as yet led to entirely satisfactory results. They all possess the common formula, $C_{17}H_{25}NO_3$, and have been found to consist of a basic tropine or pseudo-tropine, $C_8H_{15}NO$, and tropic acid, $C_9H_{10}O_3$, which has been artificially produced by Ladenburg and Rugheimer.

By boiling these alkaloids with acids or alkalies, they are decomposed into tropine and tropic acid. By the substitution of tropic with other acids, Ladenburg has succeeded in producing certain semi-artificial substances, which he has termed "tropëines."

Atropine is found in *atropa belladonna*, *datura stramonium*, *hyoscyamus niger*, and *duboisia myoporoides*. Daturine is mentioned as being a mixture of atropine and hyoscyamine. Hyoscyamine is derived from the same plants as atropine, and, like it, may be split up into tropine and tropic acid, but these products were formerly known as hyoscyne and hyoscinic acid. Hyoscyne is obtained from *hyoscyamus niger*, but may also be derived from hyoscyamine; it is much more difficult of crystallization, is isomeric with hyoscyamine, and decomposable into pseudo-tropine and tropic acid.

For hyoscyne, Harnack has proposed the name of "Sikeranine," on account of the term hyoscyne having formerly been applied to one of the products of decomposition of hyoscyamine. Homatropine is one of the semi-artificial tropëines obtained by the action of amygdalic acid on tropeïne, thus producing *oxytologlytropheïn*.

So far as their action is concerned, that of atropine and hyoscyamine is supposed to be identical, the two drugs differing only in their effects upon the central nervous system. Hyoscyne is said to act, in some respects, stronger, and homatropine, in all respects, weaker than atropine. Tropine is said to have no effect on the pupil, and in the experiments made with some of the semi-artificial atropines (tropëines), where tropic acid has been replaced by other acids, the effect upon the pupil was found to be either wholly negative or very much modified. These observations are of considerable importance, for if, as Gaskell maintains, the dilatation of the pupil is an active phenomenon, due to stimulation of inhibitory nerve-structures, a close connection between the action of the tropic acid molecule contained in atropine and stimulation of inhibitory nerve-structures, seems thereby clearly pointed out. The undoubted double action of atropine stimulating, as we believe, both

¹ Lehrbuch, T. Arzneimittellehre, etc.

inhibitory as well as vasomotor nerve-elements, may yet find a satisfactory explanation through a careful study of the relation existing between its chemical constitution and its physiological action.

LITERATURE OF THE PHYSIOLOGICAL ACTION OF ATROPIA ON THE HEART.—According to Dr. Lauder Brunton, atropia paralyzes the inhibitory nerve-ganglia. On page 48 of his work on *Pharmacology*, he states that both atropia and curare completely paralyze the motor or efferent nerves; but, while a very large dose of curare is required to paralyze the cardiac and vascular nerves, a very small dose suffices to paralyze those going to the muscles. On the other hand, an enormous dose of atropia is required to paralyze the nerves going to the muscles; while very small doses are sufficient to affect the nerves of the heart and of other involuntary muscles; so that we get rapid circulation, dilatation of the pupil, and restless delirium. On page 53 of the same work, we find it mentioned that atropia, in very minute doses, renders the pulse slow; that larger doses make it exceedingly rapid; and still larger doses render it slow again. The accelerator ganglia are said to remain uninfluenced by the drug. In the opinion of H. C. Wood and others, the latter ganglia are decidedly stimulated by atropia; and Dr. Roberts Bartholow, in the fifth edition of his treatise on *Materia Medica and Therapeutics*, page 435, states “that in some subjects a decided slowing of the heart takes place immediately after the administration of a considerable dose of it (hypodermatically), and in all, most probably, an instantaneous retardation of the pulse-rate; but a very decided rise in the number of pulsations quickly follows.” Bartholow, like Wood, believes that atropia not only paralyzes the filaments of the vagus, but also stimulates the cardiac accelerator nerves.

The question naturally arises, How are we to account for this primary slowing of the heart's action which follows the administration of certain doses of atropia? Is it produced by the stimulating influence which the drug exerts upon the vagus-centre, or upon the peripheral filaments, or both? In the work of Dr. Lauder Brunton, already referred to, we find atropia, hyoscyamine, and daturine enumerated among those substances which are capable of stimulating the vagus-centre in the brain, but which paralyze the inhibitory ganglia within the heart.

The peculiar action of atropia might, therefore, be easily explained by its power of stimulating the vagus-centre. It has been experimentally proven by injecting atropine into the carotids, in which case it reaches the brain before it does the heart, and an invariable slowing has been found to take place when the drug is thus administered. But when atropia is administered hypodermatically, as it was in Bartholow's cases, it would naturally reach the heart before it would the brain, and should, accordingly, paralyze the terminal filaments of the vagi in the heart before it could stimulate their centres in the brain. In this manner, however, no slowing of the heart's action could take place, for after the

terminal filaments of the vagus are once paralyzed, no amount of stimulation of its centres in the brain would produce the slightest effect. The view, therefore, which attributes to atropia a like action would seem clearly insufficient to account for all the phenomena observed.

Nothnagel and Rossbach¹ explain the phenomena as being due, not only to an excitation by atropine of the vagus-centres in the brain, but also to a similar influence on its terminations in the heart. According to these authors, the administration of large doses of atropine in man, the rabbit, and the frog, is always followed by a transient slowing of the pulse-rate, which is usually short in man, but which may at once culminate in diastolic arrest in other animals. These same authors further state it, as the result of numerous experiments, that the initial retardation is quickly followed by an acceleration of the pulse-rate, which may become from twice to three times that of the normal; they believe that finally we have paralysis of the inhibitory portion of the vagus nerves, so that their stimulation produces acceleration, rather than slowing.

This explanation by Nothnagel and Rossbach met with great opposition on the part of Harnack, according to whom the smallest doses of atropine produce paralysis of the inhibitory ganglia of the heart in warm-and cold-blooded animals alike; large doses, he said, paralyze the heart itself, but have a slightly irritating influence on it before paralysis occurs. The slowing of the heart's action is explained by Harnack as due to the paralyzing influence of atropia on the heart itself. Harnack is very decidedly against the view which admits that atropia stimulates the vagus in the heart; he even denies the correctness of the explanation given by Gnauck for the primary slowing in the heart's action produced by hyoscyne as being due to a direct stimulation of the inhibitory ganglia by this drug.

The controversy seems not yet closed on this all-important point, although the majority of physiologists in Germany incline toward the explanation of the primary slowing given by Nothnagel and Rossbach, while American and English as well as French writers appear as yet slow in accepting it.

According to our conception of this question, there is no point in the whole history of the physiological action of atropia, the decision of which is of greater importance. Unless we know whether atropia paralyzes or stimulates the terminal filaments of the vagus, and under what conditions it exerts its influence, the administration of the drug cannot be said to rest on anything like a scientific basis. In reviewing the literature of the subject, we find the best authorities almost equally divided. The difficulty, therefore, of the correct solution of the question seems fully equal to its importance. No matter which of the two opposing views we may hold, we find ourselves supported by experimental evidence

¹ Lehrbuch J. Arzneimittellehre, etc.

of the first quality, and neither is easily set aside. Thus the well-known experiments of Schmiedeberg and Koppe on the antagonism of atropine and muscarine, and those of Fraser on the antagonism between atropine and physostigmine, which latter were repeated and confirmed by Lauder Brunton, are, to all appearances, so strikingly exact as to bear almost incontrovertible testimony of the fact that atropine paralyzes, and at no time stimulates, the terminal filaments of the vagus. Still it must also be admitted that the fact that atropine antagonizes muscarine-standstill need not necessarily imply that atropine paralyzes and muscarine stimulates the inhibitory ganglia, and that all the phenomena observed depend absolutely on such action. Again, the fact that physostigmine restores the normal function of the vagus over the heart after the latter had been atropized, and artificial stimuli could not be conveyed to it through its fibres, does not necessarily imply that atropia had paralyzed and physostigmine restored the normal function of the inhibitory ganglia of the heart, and our experiments will show that even without physostigmine the function of the terminal filaments and ganglia of the vagus may be fully restored after atropization. No matter what the explanation may be, we may divide the action of atropia on the heart into three distinct stages, namely: (1) The primary slowing, followed (2) by an acceleration, which again is succeeded by (3) a second slowing, which may be either followed by a return to the normal, or terminate in diastolic arrest. These three well-marked stages have been observed by all those who have subjected the drug to careful experimentation. The slowing following the stage of acceleration has been commonly observed in all animals, since von Bezold and Blöbaum first called attention to it; and Mitchell, Keen and Morehouse, and other clinical observers have noticed its occurrence in man, in whom, as a rule, it returned to the normal. This stage, therefore, must be explained, as well as the first two stages, and exhaustion alone will not sufficiently account for it. In presenting the experiments, only those will be given which are typical.

EXP. XXVI.—May 19, 1886. Small adult dog. Heart isolated at 3.20 P. M. under morphine and curare. Venous pressure 22 c.m. Arterial pressure equal to 140 m.m. mercury. Normal nutrient: defibrinated calf's blood. Atropine sulphate used in the proportion of 1 grm. dissolved in 4000 of calf's blood.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line in the first column.
3.22	80	100	35°	Under normal blood.
23	80	100		
24	80	100		
25	81	102		
26	81	105	35	On atropized blood.
27	81	100		
28	66	85	...	On normal blood.
29	60 : 30	40	...	Auricles contracting twice, ventricles once.
30	60 : 30	0	...	Heart's action very irregular, pressure going down rapidly. Arrested in diastole; slight kneading still followed by solitary contractions.
31	...	0	35	

EXP. XXVII.—May 19, 1886. Small adult dog. Under morphia and curare. Heart isolated at 4.16 P. M. Venous pressure 22 c. m. Arterial pressure equal to 140 m. m. mercury. Normal nutrient: defibrinated calf's blood.

Time P. M.	No. of beats in 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line on the first column.
4.20	74	110	36°	Under normal blood.
21	74	112		
22	73	108		
23	73	108		
24	73	106	36	On atropized blood, 1 : 8000.
25	70	120		
26	67	126		
27	71	128	...	On normal blood.
28	70	136		
29	70	124	36	On atropized blood, 1 : 8000.
30	70	128		
31	65	138		
32	66	144		
33	67	136		
34	68	130	36.5	
35	68	126	...	On normal blood.
36	70	116		
37	72	102		
38	74	102	36.5	
39	72	102	...	On atropized blood, 1 : 8000.
40	72	130		
41	72	128		
42	71	130		
43	73	130		
44	73	90		
45	70 : 35	54	...	Auricle contracting twice, ventricle once.
46	62 : 28	20	...	Heart action irregular; distend-d.
47	...	0	37	Stopped pumping wound: pressure sinks; arrest quickly takes place; cutting away pericardium negative; slight kneading still followed by solitary contractions.

EXP. XXX.—Terrapin, 1605 grms. Calf's blood and Ringer's saline (1 : 1½). Inflow canulas in left superior vena cava and inferior vena cava. Outflow canulas in right aorta and pulmonary artery. Venous pressure 4 c. m. Arterial pressure 30 c. m.

Time P. M.	Rate per min.	Work in c. c. per min.	Temp. Cent.	
2.24	30	55	20°	
27	31	55		
32	31	56		
35	31	56	...	On atropized blood, 0.04 : 100 c. c.
36	31	52		
37	31	53		
38	30 : 15	56	...	Auricles contract twice to ventricles once.
39	30 : 15	55		
40	30 : 15	52		
41	30 : 15	52	20	On normal nutrient.
43	30 : 15	56		
44	30	57		
50	30	53		
57	32	52	...	On atropized blood, 0.03 : 100 c. c.
58	32	50		
59	31	49		
3.00	31	49		
03	30 : 15	?	...	Auricles contract twice, ventricle once.
05	30 : 15	53		
10	30 : 15	52		
15	31	53	20	
20	31	55		
25	31	54		
30	31	...	...	On atropized blood, 0.08 : 100 c. c.
35	31	...	...	
36	30 : 15	...	...	On normal blood mixture.
37	30 : 15	...		
38	30 : 15	...		
39	30 : 15	...		
40	30 : 15	20	...	Heart still in good condition. Experiment dis- continued.

EXP. XXI.—May 12, 1886. Small adult dog. Under morphine and curare. Heart isolated at 2.38 P. M. Venous pressure 26 c. m. Arterial pressure 144

m.m. mercury. Calf's blood the normal nutrient. Homotropized blood used in different degrees of strength.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on same line in the first column.
2.49	81	146	35°	Under normal blood.
50	81	146		
51	81	142		
52	82	146		
53	82	148	35	On homotropized blood, 1 : 6000.
54	89	152		
55	86			
56	86	156	...	On normal blood.
58	82	150		
59	84	148		
3.00	86	144	36	
01	88	140	...	On homotropized blood, 1 : 6000.
03	88	164		
04	90	162		
06	89	173	...	On pure blood.
07	89	173	37	
08	90	175	...	On homotropized blood, 1 : 6000.
09	91	180		
10	90	178		
11	88	174		
12	90	.....	...	On normal blood.
13	90	.....	37	
14	90	144		
16	90	136		
17	88	130		
18	89			
19	88	128	...	On homotropized blood, 1 : 2000.
20	86	86	37.5	
21	84	74	...	On normal blood.
22	84	106		
23	84	114		
24	84	128	37.5	
25	84	140		
26	83	140		
27	85	140		
28	85	139	...	On homotropized blood, 1 : 4000.
29	85	120	38	
30	84			
31	84	120		
32	82	120		
33	83	120		
34	84	122	38	
35	84	124		
36	83	112		
37	82	106		
38	82	98	38	
39	82	96		
40	82			
41	81	94		
42	80	82	38	
43	80	82	...	On normal blood.
46	82	78		
48	82	77		
50	81	74		
51	81			
52	82	96	...	On homotropized blood, 1 : 4000.
53	84	80	38	
54	84	76		
55	83	70		
56	84	66		
57	85	56		
58	86	54		
59	87			
4.00	84	40		
01	84	32		
03	82	24	...	Beginning irregular heart's action.
05	76	10	...	Great distention, followed by arrest. Slight kneading followed by single, though ineffectual contractions.

In Experiment XXVI. very strongly atropized blood was used, and the effect produced by it was, accordingly, very marked. During the first five minutes of observation, while the heart was working under normal calf's blood of the temperature of 35° Cent., the rate kept at 80

to 81 beats per thirty seconds, and the amount of blood pumped round in half a minute varied from 100 to 105 c. c. From 3 h. 26 m. to 3 h. 28 m., judging from the quantity of blood which ran through the heart during these two minutes, the latter had been exposed to the influence of about 0.05 grm. of the sulphate of atropia. The rate was quickly reduced from 81 to 66 beats in thirty seconds, the work done from 105 c. c. to 40 c. c. for the same period of time; then the heart's action became irregular, the auricles beating at the rate of 60 times to the ventricle 30 times, the work being *nil*; at last the action of the heart became still more irregular, the pressure suddenly went down, and diastolic arrest ensued, mechanical stimulation, however, still being followed by single, and not very powerful contractions. This is the typical result which follows the admission of strongly atropized blood into the mammalian heart.

In Experiment XXVII. atropized blood of only half the strength of that used in the preceding experiment was employed, and the result, as may be seen, is quite different. An increase, instead of a decrease, in the amount of work done may be noticed, accompanied by a slight decrease in the rate, followed by an attempt on the part of the latter to return to the normal. All this occurs while atropized blood is still circulating through the heart, but becomes much more apparent after this is withdrawn, and normal blood is again allowed to flow through. Finally, after repeated atropization, we obtain the effect of large doses of atropine on the heart, namely, rapid reduction of rate and work, irregularity in its action, and arrest in diastole.

In these, as well as in other similar experiments, after diastolic arrest was apparently complete, gentle kneading of the ventricle was still followed by contractions, showing that the muscular substance of the heart was still in possession of a certain amount of irritability.

In all the experiments made with homatropine on the mammalian heart, its effects were found to be identical with those of atropine used in very small doses. Its influence upon the inhibitory nerve-apparatus of the heart is decidedly less powerful than that of atropine, which is in apparent accordance with its effect upon the pupil, which is but transient when compared with that of atropine. Experiment XXI. has been selected to represent the typical action of homatropine on the mammalian heart, as well as that of very small doses of atropine. An examination of this experiment shows that during the first three observations which were made with homatropized blood, the rate is slightly increased, and the work done very considerably augmented. Homatropized blood of the strength of 1 : 2000, however, invariably reduces both rate and the work done, while when it is used in the proportion of 1 : 4000, or even less strong, it produces the opposite effect. Blood of this strength was kept circulating through the heart for 15 minutes, and, while no

increase in the rate or the work done was noticed, both were only very slowly and gradually reduced, the former from 85 to 80, the latter from 140 to 82 c. c. per 30 seconds. Atropized blood of the same strength in all the experiments made with it on the mammalian heart, never failed to produce diastolic arrest within three to four minutes. The most marked feature, however, in the effect produced by very small doses of atropine or medium doses of homatropine, is an acceleration in the heart's action, followed by a slowing, instead of, as is the case with the medium doses of atropine, at first a slowing, followed by an increase in the rate. This apparently contradictory result will be explained satisfactorily later on.

Experiment XXX. on the heart of the terrapin, represents but a portion of an experiment published elsewhere, but which, nevertheless, may with propriety be reproduced here, for the reason that it represents in a typical manner the effect produced by large drops of atropine on the heart of cold-blooded animals. The point which it is desirable to emphasize, is the reduction, by certain definite doses of atropine, of the rate of the ventricle, that of the auricles, though much weakened, remaining numerically unchanged. It happens, after atropized blood of about the strength of that used in this experiment has circulated through the heart a certain length of time, that there follows a period during which the rate of the ventricle becomes just half that of the auricles. This change in the ventricular rate comes on suddenly as a rule. After awhile, however, atropized blood being kept on, the ventricular rate is still further reduced, and, finally, diastolic arrest of the entire heart ensues. During this stage of atropization, the ventricle is from twice to three times its normal size, but the work done, in spite of the reduced rate of contraction, is generally increased. In some of my former experiments with regard to this point, published in the *Proceedings of the U. S. National Museum* for 1855, the work done by the heart during this stage is increased 100 per cent. Atropized blood being withdrawn and normal blood readmitted, the ventricle, after a short time, will be found to resume its normal number of contractions in as prompt a manner as it passed from the normal to the reduced rate. This singular phenomenon may be reproduced many times during the course of a single experiment, and the dose of atropine producing it, so graduated as to keep it up any desired length of time.

It is a remarkable fact, that very small doses of the drug never produce this effect. Atropized blood, mixed in the proportion of 1 : 10,000, may be allowed to circulate through the heart for several hours in succession, and no such result will follow, even if the heart, during that time, has been exposed to the influence of a much larger total amount of atropia than would suffice to produce it when used in a more concentrated form. Under these circumstances the rate is increased from three to five beats per minute, the size of the entire heart undergoes great

reduction, its systole is lengthened, its diastole correspondingly shortened, the work done greatly reduced in amount. This condition may go on until it almost resembles one of systolic arrest, the diastole becomes completely abolished, and no blood whatever is being pumped around. Small doses of atropine, therefore, produce an apparently opposite result from that which is produced by large doses, and this is a point upon which it is desired to lay particular stress in this connection.

Thus Bowditch and Luciani found the contractions both of the frog's heart containing the ganglia and of the apex alone, were rendered more powerful by atropine, while Gnauck, on the contrary, found that the contractions of the ventricle were diminished both by atropine and hyoscyamine. Kronecker and Schapiro believed that they had found that both these apparently contradictory results were correct, but at different temperatures. They state that when the temperature is low ($70-80^{\circ}\text{C}.$) the ventricular contractions are enlarged by atropine, but diminished by it when the temperature rises above $15^{\circ}\text{C}.$ We believe that this explanation is insufficient, if not entirely wrong. The phenomena observed by Kronecker and Schapiro depend entirely on the temperature of the heart, or the circulating medium, and have little or nothing to do with the action of atropine on that organ.¹ From the experiments which are here published, as well as elsewhere, it is, I think, clear that the difference in the character of the contractions observed by Bowditch and Luciani on the one hand, and Gnauck on the other, as to the effect of atropine on the heart, is a matter of *dose of the drug* rather than of temperature. In experimenting on the heart with circulating media of different degrees of temperature, it will be found that those of low temperature will cause a reduction in the rate as well as an increase in the size of the contractions, and *vice versa*. The heart, therefore, in this respect, and under the influence of blood of different degrees of temperature, behaves somewhat similar to what it does when under the influence of different doses of atropine, larger doses of atropine corresponding in their effect to circulating media of low temperatures, the smaller ones to circulating media of higher temperatures, and this, perhaps, explains the errors made by Kronecker and Schapiro.

EXP. XII.—April 29, 1886. Dog, 5400 grms. Under morphine and curare. Heart isolated at 4 35 P. M. Calf's blood. Venous pressure 16 c. m. Arterial pressure 138 m. m. mercury at start. Hyoscinated blood, 1 : 4000

Time P. M.	No. of beats per 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	
4.39	85	75	40°	Under normal blood.
40	85	75		
41	85	75		
42	84	76		
43	85	78	40	On hyoscinated blood.
44	80	70		
45	78	34		On normal blood.
46	74	26	...	

¹ See the author's explanation of the influence of blood in different degrees of temperature on the heart of the terrapin.—Proc. U. S. Nat. Mus., 1885. Washington, D. C.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
4.47	80	40	40°	
48	78	44		
49	78	64	...	On hyoscinated blood.
50	70	33	...	On normal blood.
51	74	30		
52	75	30	40	
53	75	30		
54	74	28		
55	73	26		
56	73	28	...	Arterial pressure fixed at 124 m. m.
57	73	30		
58	73	30	40	On hyoscinated blood.
5.00	67	...		
01	66	13	...	On normal blood.
03	65	24		
04	63	20		
05	63	...		
06	62	24		
08	60	28	40	On hyoscinated blood.
10	58	16		
12	58	8	...	On normal blood.
13	57	0		
14	56	0	...	Arterial pressure fixed at 100 m. m.
16	59	6		
17	64	4		
19	62	0	...	Stopped pumping wound; pressure sinking grad-
20	60	0		ually.
21	55	0		
22	53	0		
23	51	0	...	Heart greatly distended. Final arrest in diastole.

EXP. XI.—April 29, 1886. Dog, 4970 grms. Under morphine and curare. Heart isolated at 3.10 P. M. Venous pressure 18 c. m. Arterial pressure 150 m. m. mercury. Calf's blood. Hyoscinated blood, 1 : 6000.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
3.16	95	86	38.5°	Under normal blood.
18	94	85		
20	95	85	39	On hyoscinated blood.
21	90	76		
22	86	62		
23	84	60	...	On normal blood.
24	90	56		
26	95	80	39.5	
28	96	76		
29	95	72		
31	94	71		
33	94	71		
34	94	68	40	On hyoscinated blood.
35	89	60		
36	88	50		
37	88	32	...	On normal blood.
39	86	...	40	
40	86	10	...	Pressure begins to go down.
41	85	0	...	Stopped pumping wound.
42	80	0	40	Heart in diastolic distention; arrest.

EXP. XXXI.—May 25, 1886. Small adult dog. Under morphine and curare. Heart isolated at 2.22 P. M. Calf's blood. Venous pressure 18 c. m. Arterial pressure 136 m. m. mercury. Hyoscinated blood contained 1 grm. of the drug in 800 c. c. of calf's blood.

Time P. M.	No. of beats per 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	
2.31	86	60	35°	Under normal blood.
32	86	58		
33	88	60		
34	88	62		
35	88	65	35.5	On hyoscinated blood.
36	93	50		
37	92	53	...	On normal blood.
38	90	55		
39	94	70		
40	95	70	35.5	
42	97	68	...	On hyoscinated blood.
43	97	60		
44	99	24	...	On normal blood.
45	103	0	...	Stopped pumping wound.
47	0	0	36	Pressure rapidly sinking; arrest in diastole.

EXP. XXVII.—March 4, 1886. Terrapin, 890 grms. Beef's blood and Ringer's saline (1:1). Canulas as usual. Venous pressure 6 c.m. Arterial pressure 16 c.m. Hyoscinated blood (a) 0.03:100 c.c.; (b) 0.25:100 c.c.; (c) 0.5:100 of normal blood mixture.

Time P. M.	Rate per min.	Work in c.c. per min.	Temp. Cent.	
3.20	32	14	18°	Under normal blood mixture.
25	32	14		
30	32	14		
35	32	15		
40	32	15	18	On hyoscinated blood (a).
41	35	16		
42	33	16		
43	31	13		
44	31	12		
45	30	12		
46	30	12	...	On normal blood mixture.
55	32	20	19	
4.00	32	15		
03	33	17		
06	33	16	...	On hyoscinated blood (b).
07	32	15		
08	32	14		
09	31	11		
10	30	11		
11	28	10		
12	28	11		
13	26	11	20	
14	25	11		
15	25	10.5		
16	25	12		
17	25	13		
18	25	12.5	20	
19	25	12.5	...	On normal blood mixture.
20	25	12.5		
21	25	12		
22	25	13		
24	28	13		
28	29	15		
32	31	13		
36	32	14	...	On hyoscinated blood (c).
37	31	13		
38	30	11		
39	28	10		
40	26	10		
41	25	7		
42	24	7		
43	24	6		
44	24	5		
45	24	4		
46	23	3.5	...	Auricles largely distended; contractions barely
47	23	3		[perceptible.
49	22	3	...	Heart's action getting to be irregular. Obser-
55	20	1	21	[vations discontinued.

In Experiment XII. on the heart of the dog, hyoscine was used in the proportion of 1 gm. of the drug dissolved in 4000 c. c. of defibrinated calf's blood. The first observation with blood of this strength shows a decrease in the rate of 9 beats in 30 seconds, or 18 beats per minute, and a total decrease in the work done of 52 c. c. per 30 seconds, or 104 c. c. per minute. The maximum reduction of both rate and work was reached after hyoscinated blood had run through the heart three minutes. Upon the readmission of pure blood, the rate went up to 80 per 30 seconds, or 6 beats, but finally remained at 78; the amount of work done was increased from 26 to 64 c. c. Hyoscinated blood being again turned on, for only one minute, the rate went down suddenly from 78 to 70 and the work done from 64 to 30 c. c. in 30 seconds. Pure blood now readmitted, though slightly increasing the rate, did not give rise to a corresponding increase in the work. During the entire experiment with hyoscine the

rate of the heart was reduced from 85 beats to 51 beats per 30 seconds, the temperature of the circulating blood varying 1° C., being 40° at the beginning and 39° at the end. The heart was finally arrested in diastole, the muscular walls still responding to mechanical stimulation.

In Experiment XI. hyoscine was used in the proportion of 1 gm. to 6000 c. c. of calf's blood. The effect which is produced on the rate is quite as decided as in the preceding experiment, while the work done does not experience the same amount of reduction.

In Experiment XXXI., in which hyoscine was used in the proportion of 1 : 8000, the result, as may be seen, is quite different. An increase instead of a decrease in the rate follows the admission of hyoscinized blood into the heart; the work, however, is slightly decreased. This is the usual result obtained with hyoscine used in this proportion. Out of three experiments including eleven observations, an initial increase in the work done was noticed only once.

In Experiment XXVII. on the terrapin we have an illustration of the effects of both large and small doses combined; the latter causing an increase in the rate and the amount of work done in a given time, the former giving rise to a decided decrease in both.

Comparing the effect of hyoscine with that of atropine on the heart, the great similarity with which both influence that organ must be apparent. The only difference which is noticed is a quantitative not a qualitative one. Both, no doubt, stimulate the vasomotor as well as the inhibitory ganglia and their nerve filaments. Atropine, however, seems to have a somewhat more powerful influence on the vasomotor portion of the nerve apparatus than hyoscine has; besides, hyoscine does not seem to stimulate the muscular substance to the same extent as is done by atropia. Both resemble each other in that larger doses are required to produce inhibitory excitation, and smaller ones only suffice to stimulate the vasomotor ganglia. As in the case of atropine, diastolic arrest is brought about by stimulation of the inhibitory nerve apparatus and the accompanying musculo-motor exhaustion.

EXP. VII.—April 27, 1886. Dog, 5445 grms. Under morphine and curare. Heart isolated at 3 P. M. Calf's blood. Venous pressure 15 c. m. Arterial pressure 134 m. m. mercury. Hyoscyamized blood, 1 : 4000.

Time P. M.	No. of beats per 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	
3.08	60	80	34°	Under normal blood.
09	60	80		
10	63	75		
11	65	70		
13	70	65	35.5	On hyoscyamized blood.
15	70	65		
16	70	60		
17	69	65	...	
18	61	49	36	On normal blood.
20	60	35		
22	60	30	...	
23	70	22		
25	71	46		

Time P. M.	No. of beats per 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	
3 27	72	44		
29	71	42	...	On hyoscyamized blood.
31	62	25		
33	57	15		
35	51	0	...	Stopped pumping wound; pressure going down quickly; great distention. Final arrest in diastole. Gentle kneading still followed by contraction.
38	48	0		

Exp. XXXII.—May 25, 1886. Small dog. Under morphia and curare. Heart isolated 3.40 P. M. Venous pressure 22 c. m. Arterial pressure 136 m. m. mercury. Calf's blood. Hyoscyamized blood 1 : 8000.

Time P. M.	No. of beats per 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	
3.47	100	110	37.5°	Under normal blood.
48	100	108		
49	100	110		
50	100	112		
51	100	112	37.5	On hyoscyamized blood.
52	94	162	...	
53	92	158	...	On normal blood.
54	91	98		
55	91	100		
56	91	100	38	
57	91	100	...	On hyoscyamized blood.
58	91	110		
59	92	114		
4.00	92	118	39	On normal blood.
01	92	112		
02	92	102		
03	93	106	...	On hyoscyamized blood.
04	92	80	39	
05	92	68		
06	92	14	...	On normal blood.
07	100	0	...	Stopped pumping wound; pressure rapidly sinking. Diastolic arrest quickly followed.
08	102	0	39	

Exp. XL.—June 2, 1886. Small adult dog. Under morphine and curare. Heart isolated at 3.40 P. M. Venous pressure 22 c. m. Arterial pressure 150 m. m. mercury. Calf's blood. Hyoscyamized blood, 1 : 8000.

Time P. M.	No. of beats per 30 sec.	Work in c. c. per 30 sec.	Temp. of blood in Cent.	
3.44	92	140	40°	Under normal blood.
45	92	140		
46	93	140		
47	94	142	...	On hyoscyamized blood.
48	93	152	40	
49	93	148		
50	88	140		
51	88	138		
52	88	138	40.5	On normal blood.
53	88	132		
54	89	138		
55	90	146		
56	90	143	...	On hyoscyamized blood.
57	86	156		
58	91	148	41	
59	91	138	...	On normal blood.
4.00	92	140		
01	92	140		
02	93	142		
03	93	150	41	
04	93	156	...	On hyoscyamized blood.
05	90	164		
06	91	136	...	On normal blood.
07	92	100	...	Beginning irregularity in the rhythm.
08	92	0	41	Stopped pumping wound; arrest.

Exp. VI.—January 23, 1886. Frog, 110 grms. Beef's blood and Ringer's saline (1 : 1). Inflow canula in inferior vena cava. Outflow canulas in two aortic trunks. Venous pressure 4 c. m. Arterial pressure 12 c. m. Hyoscyamized blood, (a) 1 : 10,000, (b) 1 : 5000.

Time P. M.	Rate per min.	Work in c.c. per min.	Temp. Cent.	
4.00	35	9	18°	Under normal blood mixture.
05	35	9		
10	35	9		
15	35	9	...	On hyoscyamized blood (a).
17	40	9	18	
19	40	9.5		
21	38	11		
23	35	10		
25	35	10	18	
30	35	10		
35	33	10		
40	33	10	18	
44	30	9	...	On normal blood mixture.
46	34	9		
50	34	9		
55	36	8.5		
59	36	8.5	18.5	On hyoscyamized blood (b).
5.01	44	10		
03	41	9.5		
07	38	9		
11	35	8.5		
15	35	8	18.5	
20	35	8		
25	34	7.5		
30	34	7	...	On normal blood mixture.
35	31	7		
40	31	7		
45	35	8		
50	35	8.5		
55	35	9	19	Observations discontinued.

In Experiment VII. hyoscyamine was used in the proportion of 1 : 4000. During the first observation with hyoscyamized blood, the rate was reduced 9 beats per 30 seconds, and the work done was decreased from 60 c. c. to 30 c. c. for the same interval. Pure blood being now turned on, the rate promptly returned to the normal, the work, though increasing somewhat, did not again reach the normal amount. The result of the second observation with hyoscyamized blood was a reduction in the rate from 69 to 48 beats per 30 seconds and the work became nil. The heart, especially the ventricle, was largely distended, stopped pumping around, the pressure quickly went down and diastolic arrest followed.

In Experiment XXXII. hyoscyamine was used in the proportion of 1 : 8000. We notice here also a reduction of 4 beats in the rate during the first minute and of 3 additional beats per 30 seconds, during the following two minutes. The reduction in the rate takes place much more gradually in this experiment than in the preceding one, due to the diminished strength of hyoscyamized blood. The later observations show an increase in the rate. The work is increased in the beginning and decreased toward the end of the experiment when the heart is arrested in diastole.

In Experiment XL. we again find at first a decrease and then an increase in the rate due to hyoscyamized blood. This observation is of great importance, and throws considerable light on the character of the action of hyoscyamine on the heart. Hyoscyamine, like atropine, excites both inhibitory and accelerator nerves, the latter being influenced by comparatively small doses which, however, are themselves insufficient to affect the inhibitory apparatus. On the other hand, when the dose of

the drug, applied to the heart, happens to be sufficiently large to stimulate both these nervous structures alike, inhibitory stimulation becomes manifest before that of the accelerator nerves in the same manner as this occurs when electrical stimulation is applied. Hence the primary decrease, as due to the action of hyoscyamine, being followed by a subsequent rise in the rate of the heart.

Experiment VI. on the heart of the frog, shows an initial increase in rate followed by a decrease below the normal. Small doses invariably give rise to an increase in the rate, but if hyoscyamized blood is allowed to run through the heart for a longer time than is sufficient to produce the maximum increase, the rate begins to fall as under larger doses, so that, in this experiment, we have the effects of small as well as large doses. As a rule, the mammalian heart reacts much more promptly than does that of cold-blooded animals.

Exp. XIX.—May 11, 1886. Dog, 9750 grms. Under morphia and curare. Heart isolated 2.38 P.M. Venous pressure 16 c.m. Arterial pressure equal to 146 m.m. mercury. Calf's blood the normal nutriment. Daturine used in the proportion of 1 : 8000.

Time P. M.	No. of beats in 30 sec.	Work in c.c. per 30 sec.	Temp. of blood in Cent.	The circulating fluids were supplied to the heart at the time mentioned on the same line in the first column.
2.41	83	116	36°	Under normal blood.
43	83	115		
44	82			
45	82	115		
46	82	115	36	On daturine blood.
47	85	100		
48	86	100		
49	82	100	...	On normal blood.
50	85	100	36	
51	85	102		
52	89	104		
53	90	102		
54	92	102		
55	96	104		
57	96	110	...	On daturine blood.
58	97	94	37	
59	96	70	...	On normal blood.
3.00	94	70		
01	95	70		
02	96	90		
03	95	109		
04	96	109		
05	97	110	38	On daturine blood.
06	95	90		
07	95	75		
08	93	65	38	On normal blood.
09	93			
10	93	68		
11	93	70		
12	92	80		
13	91	...	38	
14	91	85		
15	91	90		
16	92	...	...	On daturine blood.
17	89	55	38	
18	88	50		
19	86	45		
20	84	20		
21	84	0	38	Heart's action becoming irregular; stopped pumping wound; great dilatation, followed by sudden arrest in diastole.

Exp. XXIII.—February 24, 1886. Terrapin, 960 grms. Beef's blood and Ringer's (1 : 1). Canulas as usual. Venous pressure 7 c.m. Arterial

pressure 18 c.m. Daturine blood, (a) 0.01 : 100 c.c., (b) 0.02 : 100 c.c., (c) 0.04 : 100 c.c.

Time P. M.	Rate. per min.	Work in c.c. per min.	Temp. Cent.	
3.00	35	25.5	...	Under normal blood-mixture.
05	35	26		
15	35	26		
20	36	25		
25	36	25		
30	36	24		
36	36	24	...	On daturine blood (a).
37	38	40		
38	36	47		
39	35	40		
40	35	32	...	On normal blood-mixture.
42	36	38		
50	36	38		
55	36	38		
4.00	36	37		
05	37	39		
10	37	40		
15	36	41		
18	36	40	...	On daturine blood (b).
19	38	45		
20	36	35		
21	36	35		
22	34	26		
23	33	25		
24	31	28	...	On normal blood-mixture.
25	31	37		
26	30	43	22.5°	
27	31	41		
29	29	45		
35	32	50		
40	33	40		
45	35	41		
50	36	40		
55	36	39	...	On daturine blood (c).
56	38	42		
57	34	37		
58	32	30		
59	30	27		
5.00	29	24		
03	24	20		
05	26	18		
07	26	18	...	On normal blood-mixture.
09	26	15	...	Auricles greatly distended; barely perceptible
15	27	22		[contractions.]
20	28	27		
25	29	28		
30	30	30	...	Auricles almost recovered.
35	32	33	...	Observations discontinued.

Three experiments were made with daturine on the dog's heart, from which No. XIX is selected as representing what occurred in all. Small doses cause a slight increase, large ones a decrease in the rate. Out of the ten observations with daturine, divided between three experiments, a slight increase in the work occurred but once on small doses, which, although giving rise to an increase in rate, as a rule, decrease the amount of work done.

As shown in Experiment XXIII. on the terrapin, a slight initial increase in the rate occurs every time daturine blood is admitted into the heart. The increase in the work amounts at times to 100 per cent., the decrease coming on only after daturine blood has been kept circulating through the heart for a long time, this being equal to the effects of large doses, which latter, when applied to the heart at once, always reduce the rate very considerably. In the terrapin the auricles seem to become paralyzed long before the ventricle does when weak blood has

been flowing through the heart for a long time. Strong daturine blood produces diastolic arrest of auricles and ventricle simultaneously.

Before discussing the phenomena as observed in the foregoing experiments, it will be necessary to review briefly some of the important fundamental points in relation to the innervation of the heart, more especially in the light of the more recent researches on the sympathetic nervous system by W. H. Gaskell.¹

According to the views most generally received, the heart of both cold- and warm-blooded animals contains three kinds of nervous ganglia, endowed with different functions, namely: motor ganglia, accelerator ganglia, and inhibitory ganglia. The motor ganglia are supposed to be connected by an intermediate apparatus with the inhibitory ganglia on the one hand, and by a similar apparatus with the accelerator ganglia on the other; the former retarding or stopping, the latter accelerating or augmenting the muscular contractions presided over by the motor ganglia.

The researches of Gaskell appear to have placed the existence of at least two such ganglionic masses within the heart, beyond any possible doubt, and these are the inhibitory and accelerator or augmentor ganglia. Gaskell has shown conclusively that both accelerator and inhibitory nerve fibres go to the heart in cold-blooded animals, as well as in mammals. "The vasomotor (accelerator or augmentor) nerves of the heart," according to Gaskell, "originate in the spinal cord, passing from it in the rami viscerales of the second and third and lower thoracic nerves, as fine medullated nerve-fibres, upward into the ganglion stellatum. From the ganglion stellatum, they either pass directly to the heart or else reach that organ from the annulus of Vieussens and the inferior cervical ganglion."

"When examined in their passage from these ganglia, they are found to be, without exception, non-medullated. These cardiac fibres, then, pass into the ganglion stellatum (ganglion cardiacum basale of Gaskell and Gadow) as fine medullated nerve-fibres, and pass out of it as non-medullated fibres. Their stimulation produces acceleration and augmentation in the heart's action."

"The cardio-inhibitory nerves," according to the same author, "leave the central nervous system in the rami viscerales of the vagus and accessory nerves, retaining the same fine medullated nerve-structure until they reach the heart, where they enter into connection with the ventriculo-auricular ganglia or Bidder's ganglia, and cannot be traced further, the nerves proceeding from these ganglia being almost entirely composed of non-medullated fibres; their stimulation either retards or altogether stops the heart's action."

We have, therefore, not only physiological proof of the existence of

¹ Journal of Physiology, vol. vii., No. 1.

these two kinds of nervous structures, but Gaskell has also added histological proof, which never before had been made out so clearly as was done by him.

Both inhibitory and accelerator nerves being efferent nerves, it now remains for us to pass briefly in review what is known with regard to the afferent nerves of the heart.

The well-known depressor nerve of Ludwig and Thiry carries stimuli from the heart to the brain, and stimulation of its central end produces all the phenomena which ordinarily follow stimulation of inhibitory nerves; its connection with the vaso-inhibitory centre in the brain is, therefore, rendered more than probable. Fibres are also supposed to run within the vagus which cause reflex contraction of the vessels and rise of blood-pressure; these are called the "pressor fibres." According to Lauder Brunton, the depressor fibres of the vagus seem to act on the vasomotor system through the medulla itself, while the "pressor fibres" affect it through a centre in the brain, so that, when the brain is perfect, irritation of the central end of the vagus causes increased contraction of the vessels and increased blood-pressure; but, when the brain is removed, or its function abolished by opium, it causes dilatation of the vessels, and a decrease in the blood-pressure. Most all the sensory nerves of the body may, however, affect the heart reflexly.

Drugs or other stimuli, accordingly, may affect the heart's action in either one or all of the following ways, viz.: (1) *Reflexly*, or through irritation of some sensory nerve; (2) *indirectly*, or through irritation of certain centres in the brain; and (3) *directly* through their influence on the heart and its contained ganglia.

In experimenting with drugs on the isolated heart, we can, of course, only speak of their direct action on that organ, and to this our further discussion on the subject will be confined.

In studying the foregoing experiments, we find, in the first instance, that the enormous acceleration which follows the administration of certain doses of atropine, and which forms so conspicuous a symptom in the second stage of atropine poisoning, is absent. If, however, as Harnack believes, the very smallest doses of atropine are sufficient to paralyze the terminal filaments of the vagus, and that their paralysis is the cause of the great increase in the number of pulsations, then, it would seem that there is no reason why this occurrence should not take place in the isolated heart as well as in that of the intact animal. We find, on the contrary, that the smallest doses of atropine, in the mammalian heart, increase the number of contractions only from four to twenty beats per minute, and in that of cold-blooded animals about five beats.

From a careful examination of the results of our experiments in regard to this point, we have come to the conclusion that the smallest doses of atropine which in the intact animal give rise to a great increase in the

number of pulse-beats, do not only not paralyze the filaments of the vagus, but also are quite insufficient to stimulate them—in other words, leave these structures quite intact. By small doses of atropine the vasomotor apparatus alone is stimulated, and the vagus, though also capable of excitation in much less time even than the vasomotor nerves, requires a much stronger stimulus to excite it. It is well known that, when a stimulus is applied to both these nerve-structures which is sufficiently strong to excite them, the vagus nerves would be the first to respond, and the vasomotors last. This is exactly what takes place when atropized blood is allowed to circulate through the heart of sufficient strength to excite them both. Under these conditions we obtain, first, a decrease in the frequency of pulsations, and afterward the latter will approach the normal once more, or may even exceed that number. This is shown in almost every experiment which we have made. While, however, it takes a stronger stimulus to excite the vagus, the vasomotors, though slower in responding, are aroused by much weaker stimuli, and, therefore, capable of much greater excitation than the vagus by the same stimuli, and hence the probability is very strong in favor of the latter being inhibited to the extent that the vasomotors are over-stimulated.

So far, we have found no evidence in favor of the paralyzing action of atropine on the terminal filaments of the vagus, but, on the contrary, have every reason to believe that these structures are excited by this drug, and Rossbach and Fröhlich are, in our opinion, perfectly correct in believing that the primary slowing in the heart's action due to atropine is caused, in part, by the stimulating influence which the latter exerts on the terminal filaments of the vagus within the heart. This stage does not become apparent on small doses being used, and, for this reason, it may have been overlooked by some.

The second stage, or that stage in which there is more or less acceleration in the heart's action, is, therefore, due to vasomotor stimulation only; this will be the greater, the smaller the dose of atropine used. With doses even slightly larger than are sufficient to excite the vagus simultaneously with the vasomotors, there will be either no acceleration at all or the number of beats above the normal will be very small. This is well shown in those experiments in which extremely small doses of atropine were used, but in which their influence was extended over a long period and the effect of larger doses was, finally, attained. Here we invariably noticed an acceleration followed by a slowing in the pulse-rate. Therefore, according to our interpretation, even during the stage of acceleration the vagus filaments are not paralyzed, but, if at all affected, they must be excited, the stimulation of the vasomotor apparatus being capable of much more intense stimulation than the inhibitory, simply gains the mastery, though for a short period only. In the experiments which were made on cold-blooded animals with very small doses,

a condition of the heart was reached after a certain time which was almost identical with systolic arrest. The ventricle gradually became one-third its normal size, and the auricles diminished in about the same proportion, so that no blood entered the heart and none was consequently pumped around. This would be exactly what we should expect to find, if the stimulation of the vasomotor apparatus of the heart was unantagonized by inhibitory stimulation, and this condition may obtain in the case of atropine being used in very small doses, or when very weak atropized blood flows through the heart a certain length of time, which is insufficient to excite simultaneously the inhibitory apparatus. A further proof of the fact that atropine does not paralyze the vagus filaments, is found in those experiments in which very small doses of the drug having repeatedly produced an acceleration in the pulse-rate, large doses still produced the slowing which is characteristic of them. If the ganglia and filaments of the vagus had been paralyzed by small doses of atropine, it would not have been possible to excite them afterward with slightly larger doses. According to the strength of atropized blood which is allowed to flow through the heart, we may produce either acceleration or slowing; the former is invariably brought about by small doses, the latter by larger doses of the drug. The fact that either may be produced alternately several times during one experiment and on one animal, seems strong proof in favor of small doses of atropine not paralyzing the inhibitory nerves, and of larger doses stimulating instead of paralyzing the structures. The increase in the amount of work done during a certain stage of atropine-poisoning seems to be another proof in favor of this view of the subject. Vasomotor stimulation, pure and simple, causes the heart to beat more frequently, at the same time shortens the diastole and diminishes the carrying capacity of the ventricle, so that a decreased amount of work would be what we should expect to find under these conditions. We find, however, that the amount of work is increased during a certain stage of atropization; this stage is of short duration in the mammalian heart, but lasts much longer in the heart of cold-blooded animals. The immense amount of work which is done during this stage is due to the presence of inhibitory as well as vasomotor excitation, the former favoring the relaxation of the ventricle, hence increasing its capacity; the latter giving rise to increased frequency in the contractions; or in case the latter are decreased in number, as is the case when the inhibitory stimulation is about to gain the mastery, simply adds the extra amount of force required to pump around the abnormally large amount of blood, without increasing the number of the contractions. As soon, however, as the increased number of cardiac contractions gives way to a decrease, we also know that inhibitory excitation is beginning to gain the upper hand, and, unless the heart is quickly withdrawn from under the influence of atropine, diastolic arrest is certain to follow in a

short time. This is the condition which prevails during the so-called third stage of atropine poisoning. Our experiments show that the heart may recover perfectly from this condition, when atropized blood is withdrawn and pure blood is admitted, in time to prevent complete vasomotor exhaustion. The action of atropine being kept up, the heart is finally arrested in diastole as a consequence of vasomotor exhaustion from overstimulation and of inhibitory excitation. The muscular substance of the heart still responding to mechanical irritation even after diastolic arrest is complete, the order in which the different structures composing the heart are paralyzed is probably as follows: First, the vasomotor ganglia and their filaments. Second, the inhibitory ganglia and their filaments. Third, the muscular substance. Thus far, then, all the phenomena observed on the heart under the influence of atropia have been explained by the stimulating influence of the latter on the inhibitory and vasomotor nerve apparatus alone, and without the assumption of the inhibitory nerve apparatus being paralyzed at any time before diastolic arrest is produced. If, however, atropine stimulates the inhibitory nerve structures of the heart, it would seem that it ought also to stimulate these structures in organs other than the heart. The question now arises, What evidence have we of the stimulating influence of atropine on the inhibitory nerve elements supplying organs other than the heart?

When we take into consideration the large amount of work which the heart has to perform, and the powerful contractions which it has to execute constantly, it must become apparent, even without any other evidence to favor the view, that the vasomotor nerve-supply of this particular organ must be enormous when compared to that of other organs. This fact, therefore, must be kept in mind when we attempt to compare the effect of atropine on other similarly innervated organs to that which this drug exerts upon the heart. The pupil and the small intestine are examples of organs which are capable of contraction and relaxation. These organs, like the heart, are supplied with both motor and inhibitory nerve ganglia, but it is not at all likely that, quantitatively, their motor nerve supply is in any degree as great as that of the heart, and therefore the influence of atropine on the nervous structures of these organs cannot form so prominent a feature as it does in the case of the heart. This, of course, must also be true to a certain extent, at least, of the inhibitory nerves going to these organs. Smaller doses of atropine must, therefore, suffice to produce the characteristic effects of the drug than are required in the case of the heart. Nevertheless, in every other respect and if the interpretation of the nature of the action of atropia upon the automatic nerve ganglia of the heart, which is here given, be correct, and it is further to be presumed that the same stimuli must naturally affect allied organs, the histological structure and physiological function of which is similar, alike, or nearly so, then the evidence

ought not to be wanting which favors the similarity or identity of the action of atropine on these organs with that which the latter drug has upon the heart.

With regard to the pupil, Gaskell says:

"It is a striking and highly suggestive fact that the anatomical course and the histological characters of the nerves which dilate the pupil, are precisely similar to the inhibitory nerves of the circular muscles of the intestines, etc., which run in the abdominal splanchnics. In both cases they leave the central nervous system in the thoracic outflow of visceral nerves, the one passing out in those upper rami viscerales directed upward to form the cervical splanchnics; the other in those lower rami viscerales which pass downward to form the abdominal splanchnics. In both cases they leave the central nervous system among the fine medullated fibres of the anterior roots, the special anterior roots which contain the dilator fibres of the pupil being, according to Budge, the second, third, and fourth thoracic—according to my own observations in the dog, more especially the second thoracic; in the frog they pass out in the anterior root of the fourth nerve.

"In both cases they pass over the lateral ganglion (main sympathetic chain) along the corresponding splanchnic nerves to the distal ganglia before they alter their histological characters; the one passing directly to the superior cervical ganglion in the bundle of fine medullated fibres which can be dissected out of the conjoint vago-sympathetic in the neck, the other in the bundle of similar fibres which passes along the abdominal splanchnics into the semilunar ganglia. In both cases, they cannot be traced further as medullated fibres. In the one case they, in all probability, lose their medulla in the distal semilunar ganglion; in the other, with equal probability, in the distal superior cervical ganglion.

"The histological, anatomical, and physiological evidence, all point to the conclusion that in the sphincter muscle of the iris we have yet another example of a muscular structure supplied by two nerves of opposite character, the one motor, the other inhibitory."

In this manner Gaskell has furthermore shown that the muscular tissues of the visceral and vascular systems are supplied by two sets of nerves, of which the one sets these tissues in activity and causes their contraction; the other inhibits their contractions, and causes their relaxation. The accelerator nerves of the heart, according to Gaskell, belong structurally, as well as anatomically, to the group of vasomotor nerves, and the nerves which retard or stop the heart's action, to the class of inhibitory nerves.

The question, therefore, arises, What analogy do we find in the action of atropine and its congeners, on the heart, and that which these drugs have on other similarly innervated organs? Let us first examine their action on the pupil.

1. *The Pupil.* It is a well-known fact that all the members of the atropine group cause dilatation of the pupil. Dilatation of the pupil, however, according to the latest researches, is brought about by a stimulation of the inhibitory nerves supplying it, paralysis of these nerves being followed by contraction of the pupil. We have, therefore, here an example of atropine stimulating inhibitory nerve-structures as it does in the heart, the analogy appearing to be quite complete. Atropine, how-

ever, is also known to be a vasomotor stimulant when used in very small doses, and stimulation of the vasomotor nerves supplying the pupil would cause its contraction. It is well known that, under conditions hitherto not yet fully determined, atropine sometimes causes transient but slight contraction of the pupil before dilatation comes on. This would be due, according to our interpretation, to too small doses of atropine, and as soon as a sufficient amount of atropine is absorbed, dilatation must supervene; for the vasomotor nerve apparatus, though quickly and intensely stimulated, is rapidly exhausted by too large doses; the inhibitory nerve apparatus, on the other hand, requiring larger doses to set it into full activity. We have here, as in the case of the heart, simply to regulate the dose according to the effect we wish to produce. If the smaller doses of atropine were sufficient to paralyze the inhibitory nerve-apparatus, then contraction of the pupil would have to follow invariably, and the application of larger doses would not change anything in this result. The facts, however, are quite different, as is well known. In the pupil, therefore, we have a very perfect example illustrating the action of atropine on the two kinds of nerve-structures, exactly as this was made out in the case of the heart.

2. *The Intestine.* The best text-books state that atropine, in very small doses, increases the peristaltic movements of the intestine; moderate doses completely arrest these movements, but do not destroy the irritability of the muscular fibres; large doses stop the movements, and also paralyze the involuntary muscular fibres so that they contract either very feebly, or not at all, on direct irritation. In the case of the intestine, we have yet another example of small doses of atropine stimulating vasomotor nerves, and of larger doses stimulating inhibitory nerves.

3. *The Bloodvessels.* In experiments with atropine on the bloodvessels, published by me in this journal for July, 1885, it was clearly shown that atropine causes at first contraction, and then dilatation of these vessels. We have, therefore, here, as elsewhere, evidence of vasomotor stimulation preceding inhibitory stimulation when small doses are used. In the experiment referred to, it was, however, also shown that this initial contraction took place only during the first, and, at most, the second observations, but not the subsequent ones, apparently indicating that the vasomotor nerves lost their excitability long before the inhibitory nerves did.

The evidence in favor of the uniformity of the action of atropine on these different organs might be still further increased, but the examples cited above are deemed quite sufficient to prove our point. Atropine has long been a favorite remedy of clinicians in all painful spasms of involuntary muscles, such as lead colic, simple colic, asthma, the spasms set up by renal and biliary calculi, painful spasmodic contraction of the circular muscular fibres of the neck of the womb in parturition, etc. Clinical evidence, therefore, is not lacking in proof of the fact that atro-

pine and its allies cause the relaxation of involuntary muscular fibres, by their stimulating influence on inhibitory nerves and their ganglia.

From this brief consideration of the more prominent facts brought out by these experiments, the conclusions are as follows, viz.:

1. Atropine, homatropine, hyoscine, hyoscyamine, and daturine are stimulants of the sympathetic nerve apparatus of the heart.

2. The vasomotor portion of this nerve apparatus is affected by comparatively small doses of these drugs, giving rise to either acceleration or augmentation in the heart's action.

3. The inhibitory portion is excited by larger doses only, giving rise to slowing of the heart's action, and, finally, causing diastolic arrest.

4. The muscular substance of the heart is greatly excited by atropine, homatropine, and daturine, and only slightly so by hyoscine and hyoscyamine.

5. The vasomotor nerves and their ganglia are the first to become exhausted, the inhibitory nerves and their ganglia are the next, and the muscular substance is exhausted last of all.

6. The slowing of the heart's action which follows the administration of these drugs in the intact animal, may be sufficiently accounted for by their influence on the inhibitory nerves and ganglia of the heart itself.

7. The acceleration following the administration of certain doses of these drugs cannot be sufficiently accounted for by their action on the accelerator nerves and ganglia within the heart, but is principally due to causes resident outside this organ.

In conclusion, I have to acknowledge my indebtedness to Professor H. Newell Martin for kindly placing at my disposal the well-equipped laboratory under his charge at the Johns Hopkins University, Baltimore, where the experiments on the heart of the dog were made. I also take this opportunity to thank Dr. John C. Hemmeter for valuable assistance rendered me during some of the preliminary work on the dog's heart. The experiments on the heart of the frog and terrapin were performed at the laboratory of the Museum of Hygiene, under the auspices of the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

TYPHOMALARIAL FEVER.

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THE early use of any new medical term is necessarily somewhat indefinite, especially when those responsible for the name have not at first clearly indicated the condition which it is intended to signify. In America the term typhomalarial fever is widely used, if we may judge

from the number of communications on the subject to the medical journals and societies in all parts of the United States and Canada. To the majority of English practitioners, whose experience has been limited to their own country, the name is unfamiliar, and to all it is wanting in accurate definition. Now that we have admitted the term into our nosology, under official sanction, it is well that we should endeavor clearly to understand to what class of cases it should apply. Although it has been used for a quarter of a century, the term typhomalarial fever is not yet so well defined as to bear a universal significance. The London College of Physicians, in its nomenclature of disease, defines it as a *combination of malarial and enteric fevers*.¹ The Section of Medicine at the International Medical Congress held in Philadelphia in 1876, expressed the opinion² that "typhomalarial fever is not a special or distinct type of disease, but the term may be conveniently applied to the compound forms of fever which result from the *combined influence of the causes of the malarial fevers and of typhoid fever*."

A similar though somewhat different view is well stated by Dr. E. G. Russell in a paper on malarial fevers read before the Epidemiological Society of London in 1881.³ He says:

"When a distinctly malarial complication accompanies and is bound up with true enteric fever, we have the disease that has been recognized, and described by numerous writers of divers periods and lands, as paludo-enteric or typhomalarial fever."

If any distinguishing term is required for such cases, which undoubtedly exist, I should prefer the term "malarial enteric fever" which I proposed in my paper on "Fever at Suakim."⁴ The most correct description would be to put down both diseases, enteric fever and malaria, just as one would enter syphilis and scarlet fever if the two coexisted. But again, Dr. Russell says:

"Typhomalarial fever may be taken as affording an illustration of the parallelogram of forces; the malarial poison and the typhoid poison being the two forces acting on a point—the patient—and being represented in magnitude and direction by the two sides of the parallelogram, each produces its full effect in its own proper direction; the resultant being represented in magnitude and direction by the diagonal through this point—*i. e.*, by typhomalarial fever."⁵

Other observers consider typhomalaria to be, not the resultant between two causes, but describe it as enteric fever *modified* or even *induced*, by *malaria*. The chief exponents of this view are Sir Joseph Fayrer and M. Léon Colin. The former writes:

"I believe that in India enteric lesions are apt to come on in the course of miasmatic fever, and that in this condition they not only resemble but *become*

¹ The Nomenclature of Disease. Second edition. London, 1885.

² Transactions Int. Med. Congress, Philadelphia, 1876, p. xxxviii.

³ Transactions Epidemiological Society, vol. iv., part iv., p. 559.

⁴ Transactions Med.-Chir. Society, 1885-86, vol. lxix. p. 247.

⁵ Transactions Epidemiological Society, vol. iv., part iv., p. 559.

identical with those of specific enteric fever, which is caused in India as in England.”¹ Or again, “I am, and have long been of opinion that a form of fever exactly like European typhoid, except in its etiology, exists in India and other hot and malarious countries, and that it is due to climatic causes, not to filth or specific causes such as give rise to it in England.”²

M. Léon Colin³ also holds that these fevers result from a transformation of paludal into typhoid fever; or, in other words, of malarial into enteric fever. Barker⁴ speaks of typhoid fever being produced by “malaria,” but he uses the latter term in the wide sense of “infected air,” not paludal miasmata only. Inspector General Maclean, Professor of Military Medicine at Netley, in his report on the enteric fever cases sent to Netley from Egypt in 1882, says:

“Medical officers, who, like the writer, have studied the disease in India, recognize two types; the first, seen in young soldiers who have been but a short time in the country, is, in all its main features, undistinguishable from enteric fever as seen in Europe. In the other, observed in the persons of those longer resident in India, a *malarial complication*, the outcome of that poison, and the changes wrought by it in the solids and fluids of the body, give a distinctly remittent character to the disease, and the lesions in fatal cases, revealed post-mortem, point unequivocally to the work of two factors, the enteric plus the malarial poison.”⁵

Surgeon-Major R. W. Jackson, in writing on enteric fever and its modification by malaria in Southeastern Africa, dissents from the hybrid view of the disease. He writes:

“From what I have seen of the disease termed typhomalaria, I am inclined to believe that the two elements do not intimately mingle in the course of the disease; the malarial appears to be more or less *parasitical* in many cases, with a decided tendency to seize on a subject debilitated by any cause.”⁶

Fleet Surgeon Norbury, C.B.R.N.,⁷ says, “The so-called typhomalarial fever is, in my opinion, simply enteric fever, and nothing else;” though, as he says, the symptoms may be modified by malaria. These both describe what I would term “malarial fever.”

The view to which I myself incline is also propounded and upheld by others whose observation of the disease is more extended than my own; sometimes set forth in published opinions, sometimes borne out by reports of cases or pathological examinations. According to this view, typhomalarial fever is not a subdivision of enteric fever, but a form of malarial fever. This opinion was held by the Commission formed for the purpose of a special inquiry into the disease during the War of the Rebel-

¹ Climate and Fevers of India: Croonian Lectures, 1882, p. 227.

² Trans. Epid. Soc., vol. iv., part iii., p. 269.

³ De la Fièvre Typhoïde Palustre: Archives Générales, 1878, part 1, p. 276.

⁴ On Malaria and Miasmata: The Fothergillian Prize Essay for 1859. By T. H. Barker, London, 1863, p. iii.

⁵ Army Medical Reports, vol. xxiii., 1881.

⁶ Dublin Journal of Medical Sciences, January, 1881, p. 17.

⁷ Medical and Surgical Notes on South African Warfare. Transactions International Medical Congress, London, 1881, vol. ii. p. 513.

lion, who reported that the camp fever then so prevalent was "bilious remittent fever, which, not having been controlled in the primary stage, had assumed that adynamic type which is present in enteric fever."¹

This I should be inclined to adopt as my definition of typhomalarial fever, merely substituting "malarial" for "bilious remittent," and not venturing to specify any cause for the assumption of the typhoid symptoms. My definition would then run as follows: *Typhomalarial fever is a malarial fever which has assumed that adynamic type which is present in enteric fever.* Several of our army medical officers appear to favor this view.

There still remain those, like Virchow,² Welch,³ and others, who would cut the Gordian knot by agreeing with Brig.-Surgeon J. A. Marston, that "there seems to be no satisfactory evidence for including a typhomalarial fever as a distinct morbid entity in our nosology."⁴ I agree with these in so far as they hold that typho-malaria is not a specific disease or distinct morbid entity; but I hold that there is sufficient justification for retaining the term in our nosology, provided we understand clearly what we intend should be its signification.

Considering, then, typho-malarial fever as a manifestation of the malarial poison, in which continued fever is accompanied by intestinal symptoms—mainly diarrhœa—and which tends to assume an adynamic or typhoid condition, I proceed to give a sketch of the disease, tracing shortly its history, or rather a history of its recognition, and then describing its symptoms and pathology. Finally, I will endeavor to give its points of difference from enteric fever, so as to help us to arrive at a diagnosis in doubtful cases.

HISTORY.—Where history reaches back to the first record of war we have mention of disease breaking out in the camps; and the attendance of disease on armies in the field has recurred with fearful regularity in all campaigns. As records became more exact (or the preservation of them more successful), descriptions of the prevailing camp-fevers have come down to us with the history of the wars. And looking through those military medical annals, we find that the ancients had to fight against the same disease as we do now, in the field and in the camp, in addition to the "filth diseases" which we now in a great measure prevent. To say that the fever of which I am speaking existed long before it was described so as to be recognizable by us, and was described long before it was named, is only repeating a truism which will hold for almost every disease. In the wars of the middle ages, armies in Italy, Hungary, and along the shores of the Danube suffered terribly from fevers,

¹ Woodward: Transactions International Medical Congress, Philadelphia, 1876, p. 312.

² Kriegstypus und Ruhr., Virchow's Archiv, Bd. lii. (1871), 1-42.

³ "Enteric Fever." Alexander Prize Essay, 1883.

⁴ Army Medical Reports, 1880, vol. xxii. p. 326.

chiefly typhus and enteric, among which cases occurred very nearly resembling what we now call typhomalarial. To come nearer to our own times, in 1760 Göttingen was visited by an epidemic, described by Röderer and Wagler¹ as *morbus mucosus*, which was a continued fever with diarrhœa and typhoid symptoms, and with pathological signs of intestinal catarrh. Then we have the records of the terrible Walcheren fever in 1809, which spread so rapidly among the British troops that in a month after landing there were only 23,000 infantry and 2000 cavalry fit to take the field, out of a force of nearly 40,000 men: the number in hospital was then nearly 3000, increased in another fortnight to 7000, and in ten days more to nearly 11,000.² This was recognized at the time as a malarial fever, and the symptoms as described by Davis and others in many cases resemble typhoid. Similar fevers are described by Pringle,³ as occurring in our troops in the low countries half a century earlier.

After the close of the Peninsular War there was no very protracted campaign in malarious countries until the great civil war in America (1862) fifty years later. During this struggle, which lasted four years, large bodies of men were encamped in low-lying districts in the valleys of the Mississippi, the Ohio, the Potomac, and the Chickahominy rivers, where malaria abounds. A complete and well organized medical service made it possible to collect reports from the various divisions of the army and afterward to compile a medical history of the war, which is a storehouse of information for all who wish to study the diseases incidental to campaigning, or to perfect the hygiene of armies. It is, therefore, to the history of the American war that we are indebted for a clearer description of the disease of which I am speaking, and it was during this war also that the term typhomalarial fever was first used. Many of the surgeons who had known enteric fever at home, found that the prevailing camp fever, though resembling typhoid—often so closely that they had no hesitation in diagnosing it—had yet in many cases differences so marked as to call for special reports. A commission was appointed to investigate the matter, and on the drawing up of statistical forms for returns of diseases in the army, Dr. Woodward, then Assistant Surgeon in the United States Army, proposed the term typhomalarial fever—the disease being considered by him to be a hybrid between enteric and malarial fever. The first official recognition of the term is in the United States Army Statistical Returns for 1862.

But the disease is not confined to armies in the field, and had been recognized before this time. Lancisci,⁴ had noticed it in the Roman

¹ De morbo mucoso. Göttingen, 1762.

² Davis: On Walcheren Fever, 1810. Introduction.

³ Observations on the Diseases of the Army, 1774.

⁴ De Noxiis Paludum Effluviis. Geneva, 1718.

marshes in the 17th century, and in America Drake¹ had described it and called it "remitto typhus" twelve years before Woodward named it. English observers in India and elsewhere had described many cases of it as malarial fevers or bilious remittent; and the French had seen it in Algeria. In late years our Army Medical Reports contain many descriptions of the disease and opinions as to its nature.

SYNONYMS.—The disease under consideration is described under many names; and various terms are used by different writers as synonymous with typhomalarial fever. I have mentioned Drake's remitto-typhus, or secondary typhus fever, as he also calls it. Then we meet with paludal-typhoid, paludo-enteric, miasmatic typhoid fever, fæco-malarial fever, bilious remittent, gastric remittent, adynamic remittent, typhoid remittent, and autumnal fever, all of which are now in use; and mucous or pituitous fever (Copeland), *typhus intermittens subintrans* and *febris intermittens typhosa* (Hermann Schmidt), which are obsolete. From a most valuable report² by Surg.-Major Veale on the Fevers from the Mediterranean, treated at Netley in 1879, I get the following: Malta fever, rock (or Gibraltar) fever, Mediterranean fever, and his own suggestion, viz., complex, or complicated fever (*febris complicata*). Many cases are also included under the comprehensive term "simple continued fever."

In giving the synonyms, I only mention terms used when the observer seems to have recognized the disease as that we are calling typhomalarial fever. The other names under which cases have been returned would seem, according to Dr. Veale, to range from enteric fever and rheumatism, to phthisis or chronic pneumonia.

ETIOLOGY.—If I say that wherever malaria is found, there typhomalaria may also occur, I need go no further in describing the climatic and telluric conditions which favor its development, for that would carry me far beyond the scope of this paper. It has been described as occurring in all four continents, and with a wide distribution in each. It is not confined to tropical or subtropical countries, though perhaps more frequent in such climates: it is not uncommon on the shores of the Mediterranean,³ and cases of typhomalaria have been described (by Dr. Handfield Jones⁴ and others) as occurring in England. Until recently, no other fevers were recognized in the Romney marshes except those due to malaria.⁵

In the tropics it would seem that the season at which it is most prevalent is the setting in of the rains (Fayrer and Don), and in more

¹ The Principal Diseases of the Interior Valley of North America. Cincinnati, 1850.

² A. M. D. Reports, 1879 vol. xxi. p. 271.

³ I believe, as was remarked at the time (Lancet, 1886, vol. i. p. 567), that it is to this cause that we must attribute the loss of a distinguished member of our profession last year, I mean Mr. Cooper Foster.

⁴ Medical Times and Gazette, June 27, 1885.

⁵ Hilton Fagge: Practice of Medicine, vol. i. p. 283.

temperate climates, as would naturally be expected, it occurs at the season when both malarial and enteric fevers are most prevalent, viz., in the autumn. With regard to individual predisposition, youth, fresh arrival in a malarious district, and any cause that tends to debilitate the individual, or to depress the spirits, seem to lay persons open to an attack. Over-crowding, or the collection of a large number of persons together, sanitary defects, foul smells, bad water, bad food, hard or harassing duties, are all mentioned by different writers. Thus, campaigning in a malarious country brings all the predisposing causes into force. Standing camps, or prolonged occupation of camping grounds where filth, decomposition, and malarial emanations exist in a subtropical or tropical heat, are most favorable to its development.¹ Some writers suggest that the presence of enteric fever is a predisposing cause; perhaps, rather, it is a cause for the prominence of intestinal symptoms. Certainly the two diseases frequently occur side by side, as is clearly seen in the reports of the American war, in those of our Zulu war, and also at Suakim last year. M. Boudin,² the French military surgeon, considered, from his experience, that malaria "excludes, and is antagonistic to" enteric fever, but I suppose he would find few supporters at the present day. The poison being essentially that which produces intermittents and remittents, the mode of their introduction into the system is probably identical.

Typhomalaria is not transmissible from person to person (Harley),³ and in this differs from enteric fever.

Having gained a hold upon the individual the poison may lie dormant for a considerable time, and this appears to be one of the marked characteristics of malarial diseases. This was observed in many cases among our troops after the Egyptian campaign in 1882, and also after the Soudan expedition of 1885; on both of which occasions men were constantly admitted to hospital for fever resembling closely enteric (and often correctly so diagnosticated) for some weeks, or even months, after arrival in England; and both among the troops at Aldershot and in Cyprus in 1882,⁴ and in the brigade of Guards in 1885, the cases, almost without exception, occurred among those who had returned from the seat of war. In 1882 it is recorded that the brigade of Guards left Alexandria at the end of October and beginning of November (from October 30th to November 7th), and cases of fever continued to be admitted to hospital for nearly nine weeks after that date; and the remark, "that the disease was of Egyptian origin, and was not due to infection from one to another in this country," seems highly probable, because the spread of it was confined to those who had been in Egypt.⁵

¹ Norbury, Trans. Int. Med. Congress, London, 1881, vol. ii. p. 513.

² *Traité des Fièvres Intermittentes, remittentes et continues de pays chaudes et des contrées marécageuses.* Paris, 1842.

³ Reynolds's System of Medicine. Art. Enteric Fever. 1st ed., 1886, vol. i. p. 610.

⁴ A. M. D. Reports, vol. xxiv., 1882.

⁵ A. M. D. Reports, 1882, vol. xxiv. p. 117.

SYMPTOMS.—The onset is often gradual, sometimes sudden, and the cases may at first show no differences from other results of malarial poisoning.

Certain premonitory symptoms are mentioned by various observers, among which tonsillitis is spoken of by more than one. Sir Anthony Home, speaking of an outbreak of fever at Sitapur, in Bengal, says, "Nothing is more frequent than the connection in point of time between a preceding tonsillitis and a following enteric fever illness."¹ I suspect that typhomalaria would be a better term to describe this outbreak, and I am unable to find any mention of a preceding tonsillitis in the articles on enteric fever in any of the various text-books. Surgeon-General Woolfreyes, in describing the fever which occurred among the troops in Natal during the Zulu war, and which he recognized as typhomalarial, says, "It, as a rule, commences with sore throat, a peculiarity."² So, too, the fever designated generally as "typhomalarial," so prevalent at the several outposts during the Galeaka-Gaika campaign in the Cape Colony, nearly always commenced with sore throat.³ Dr. Don speaks of tonsillitis preceding the continuous enteric fever of Bermuda.⁴ I noticed several cases of tonsillitis among the troops at Suakim while fever was prevalent, but was not then aware of their possible significance. I certainly met with it in some men who were never admitted to hospital then or later.⁵ The onset then is gradual, with indefinite malaise, headache, loss of appetite, and possibly chills, and pains or aches in various parts of the body. Assistant Surgeon Billings, U. S. Army, says, "The malarial element is always prominent at the commencement, the typhoid element making its appearance on the fifth or sixth day, and gradually becoming more prominent."⁶ Sickness is a distinctive and almost constant symptom, the vomited matters often being greenish.

Diarrhœa is generally present, but where camp-diarrhœa is prevalent may cause no comment.

As the disease progresses the diarrhœa may be more frequent. The stools vary: they may be greenish, as is common in remittents; watery and brown; or sometimes resembling the "pea soup" stools of enteric fever.

Now and then, when diarrhœa is the rule, a solid and apparently healthy motion may be passed in the middle of the illness. There may be constipation throughout.

¹ A. M. D. Reports, 1882, vol. xxiv. p. 81.

² A. M. D. Reports, 1879, vol. xxi., p. 294.

³ Ibid., vol. xi., 1869. Appendix. No. xi. p. 385.

⁴ I may mention that since my return from Suakim I have had several attacks of "Soudan Fever,"—clearly malarial; and that on the last few occasions I have noticed that sore throat precedes and accompanies the fever.

⁵ Report on the Treatment in the Army of the Potomac during 1864.

⁶ Fayrer: Op. cit., p. 194.

The temperature is raised from the commencement of illness; at first, it may be, with complete remissions, afterward becoming continued, sometimes very high, and often irregular. The pulse is small, feeble, often dicrotic, and rapid, and shows no relation to the temperature.

A symptom is noticed in the reports of the Zulu war which reminds us forcibly of the description of the mucous fever in Göttingen. This is a "hyperæmic condition of the entire alimentary tract, indicated by congestion of the throat and fauces, the excessive secretion of mucus, the copious mucous diarrhœa, accompanied by tenesmus, and followed after straining by a little pure blood."¹

Jaundice has been noticed in several instances, and hepatic congestion is frequently met with in the early stages. The abdomen is distended; and there may be pain and gurgling on pressure in the right iliac fossa, a frequent sign in diarrhœa. The spleen is enlarged. The tongue in severe cases is furred and swollen; later it may become dry, brown, and cracked.

In severe and prolonged cases we find subsultus tendinum, sordes on the teeth, low muttering delirium, and continual vomiting. Death results from exhaustion. It is stated that rose spots are found on the abdomen as in enteric fever, but I should almost consider the spots to be pathognomonic of the specific disease.

In cases which end in recovery, the duration of the disease is very variable. During an epidemic many men come into hospital with all the signs of a severe attack, and after a few days' illness are practically well, though careful observation might show evening fever for some time after they have left the hospital. Severe cases have a longer course than enteric fever, and linger on for seventy days or more (Maclean, Lane, Notter). In one of my cases the patient was under treatment for thirteen weeks, or ninety days. For some time after all marked illness has disappeared the temperature may go on oscillating from 98° to 102° or 103° F. at night, the patient meanwhile having a good appetite and feeling well.² This prolonged course is very characteristic, and quite different from the relapses in enteric fever; sometimes diarrhœa continues during the whole time. In some cases a rheumatic affection of the fibrous tissues round the joints and other parts³ may persist for weeks or months; in others, anæmia is the only remaining sign of illness. Tenderness over the hepatic region may be noticed throughout convalescence.

COMPLICATIONS.—Of these the chief are pulmonary congestion, bronchitis or pneumonia, hemorrhages from the bowels, or other mucous surfaces, as epistaxis. With these hemorrhages I may mention the purpuric

¹ A. M. D. Reports, 1879, vol. xxi. p. 293.

² Ibid., p. 266.

³ Ibid., p. 266.

blotches on the skin noticed in two of my fatal cases at Suakim, and reported in my paper on the fever there.¹

Purpura has been noticed as a complication of Gibraltar fever,² which sometimes at least takes the typhomalarial form. In the Zulu war, also, we are told that in some of the cases of fever there was "a cutaneous redness larger than a man's hand, which appeared in various localities, but especially on the side of the thorax, and outer side of the upper arm." This did not disappear on pressure, and on incision post mortem small blood coagula were found in the centre. It was always a fatal sign.³ Profuse perspiration with sudamina may occur. Rheumatism, sometimes attended with effusion into joints, has been observed,⁴ and has long been recognized as a usual sequela of Malta fever or Mediterranean remittent.⁵

PATHOLOGY.—A clear understanding of the pathological changes brought about by any morbid process is essential, if we wish to perfect our knowledge as to the symptoms, course, or general history of a disease. For it is by pathological examination that we are enabled to check or verify our diagnosis, and so know positively with what disease we have to deal—a point which may remain uncertain without such means of proof. I am about to venture a statement which will meet with some opposition, if I may judge by the opinions expressed by most of those who have written on typhomalarial fever—it is this. The pathological changes found after death from typhomalaria differ from those characteristic of enteric fever, and serve to distinguish the two diseases from one another: they are, in fact, the *pathological signs of malarial fevers*. Many writers state that necropsies in cases of typhomalarial fever show the peculiar ulceration of Peyer's patches which is considered characteristic of enteric fever. I believe that when the characteristic Peyerian ulceration is found we may take it that the patient has had true enteric fever, which may have been complicated with malaria no doubt, but this does not constitute typhomalarial fever.

The two diseases, as I have already mentioned, often exist side by side in the same camp, and may be treated in the same ward; the symptoms during life are much alike, and doubt may exist as to the diagnosis throughout the whole illness. What wonder then if a case diagnosticated as typhomalarial fever convict us of error in diagnosis by revealing Peyerian ulceration at the post mortem, or if a careful search in a case supposed to be enteric fever should disappoint us by the absence of enteric ulcers. A most instructive account of a simultaneous outbreak of enteric fever and of typhomalarial fever in two regiments in adjoining

¹ Trans. Med.-Chir. Society, 1885-86, vol. lxix. p. 247.

² A. M. D. Reports, 1881, vol. xxii. p. 33.

³ Trans. Int. Med. Congress, London, 1881, vol. ii. p. 513.

⁴ A. M. D. Reports, 1879, vol. xxi. p. 266.

⁵ Ibid., 1861, vol. iii. p. 507.

camps, where the two diseases could be studied side by side, will be found in the Appendix to the *Army Medical Report* for 1879. This report teems with important facts which help us to study the differences between the two diseases. In this outbreak it was at first considered that the two fevers might be one and the same disease, till fatal cases demonstrated that the two diseases were perfectly distinct: for, whereas, the necropsies in one camp showed "the local lesions of the intestinal glands which are the invariable concomitants and anatomical expression" of enteric fever, in a fatal case in the other camp the intestine was found to be perfectly healthy.¹ I do not wish to be understood to deny that ulcers may be found in the small intestine in typhomalaria: on the contrary, I imagine they may be frequently present, but they do not select Peyer's patches or the solitary glands, or confine themselves to these, as enteric fever ulcers do. The presence of ulcers in the small intestine in patients dying of malarial fevers has been observed over and over again. Annesley² and Twyning³ both mention superficial ulceration of the mucous membrane of the small intestine in protracted cases of the "congestive fever" of the cold season in India. Ulcers, sometimes possibly those of enteric fever, but sometimes quite different, were noticed in the Walcheren fever (Davis). Dr. Wall, of Calcutta, describes irregular ulceration, by no means selecting the site of Peyer's patches, and often encircling the intestine.⁴ Surgeon-Major Edge, in reporting on the camp fevers during the Zulu war, writes: "Post-mortem examination revealed the great differences between the diseases. In remittent fevers the ulceration was not in Peyer's patches or certainly not confined to them, nor were Peyer's patches or the solitary glands traceable in the great inflammation and thickening of the lower part of the ilium."⁵ Others are unable to distinguish between the ulcers in some malarial fevers and those of enteric fever, believing the former to develop into true enteric. Dr. Morehead goes further and says, "Disease of Peyer's glands . . . is not peculiar to typhoid fever only, for it occurs in cholera, in protracted diarrhoea, and in acute muco-enteritis, or as an occasional complication of remittent fever, and is a frequent one of phthisis pulmonalis."⁷

Dr. Jules Guérin,⁷ of Paris, considers that the organic lesions found in the intestine in enteric fever are the effects of virulent and ulcerative action of typhoid matters on the parts—*i. e.*, a local irritative action, not the result of the specific poison. If this were so, other irritative contents of the bowels might be expected to produce exactly the same results.

¹ A. M. D. Reports, 1879, vol. xxi. p. 253.

³ Diseases of Bengal, second edition, 1835.

⁵ A. M. D. Reports, 1879, vol. xxi. p. 306.

² Diseases of India.

⁴ Fayrer, *op. cit.*, p. 175.

⁶ Researches on Diseases in India, p. 160.

⁷ Transactions of the International Medical Congress, London, 1881, vol. ii. p. 91.

To enumerate the chief pathological appearances found in cases of typhomalarial fever: First, as to the alimentary tract. There may be congestion of the throat and pharynx, with excessive amount of secretion; and this may extend throughout the whole length of the alimentary canal. This was found in one of my necropsies at Suakim, where, besides the injection of the mucous coat, submucous ecchymoses were present. Woodward notices this condition. He has collected a number of autopsies in which the illness had strikingly resembled enteric fever, but in which dissection showed no other lesion in the alimentary canal than a smart intestinal catarrh. The characteristic lesions were "Patches of inflammation scattered irregularly throughout both small and large intestines and enlargement of the closed glands, often associated with pigment deposits."¹ Annesley says, "occasionally the mucous surface (of the intestines) is of a brick-red or purplish shade of color, apparently ecchymosed."² Twynning also mentions³ inflammation and ecchymosis of the small intestine without ulceration; and morbid vascularity of the duodenum. In cases of the Walcheren fever, Davis found the intestines of a purplish hue. Surgeon-Major Boulton mentions having seen this in the West Indies.⁴ Congestion and ecchymosis in the intestines must, therefore, be considered a frequent pathological sign in typhomalaria; and would appear to be not uncommon in remittent fever. Most observers consider the congestion of the mucous coat to be most marked in the duodenum, and upper part of the jejunum; and some describe the ilium as healthy. I have certainly seen the latter congested and ecchymosed.

In more severe or prolonged cases ulcerations may be found in almost any part of the small or large intestine, though Annesley thinks it is most commonly to be seen in the termination of the ilium; probably here he is confounding it with enteric. They are irregular ulcers, which may be small and agglomerated, or large and far apart, sometimes encircling the intestine, and not selecting the intestinal ductless glands. They are usually superficial, not penetrating beyond the mucous membrane, though they may be deep enough to cause perforation.⁵

The spleen is enlarged, soft, and friable; the liver congested and hard; the gall-bladder sometimes distended with bile. All the above, be it observed, are pathological results of malaria, not of enteric fever poison.

The lungs may show signs of the complications which affect those organs, most commonly being congested at their bases posteriorly.

Purpuric ecchymoses may be seen in the skin.

¹ Typhomalarial Fever. Transactions of the International Medical Congress, Phila., 1876, p. 331.

² Op. cit., vol. ii. p. 457.

⁴ A. M. D. Reports, 1879, vol. xxi p. 306.

³ Op. cit.

⁵ Op. cit.

DIAGNOSIS.—All those who have seen much of malaria have noted how its symptoms frequently simulate those of enteric fever, so closely, in some cases, that a diagnosis is almost impossible. This led Dr. J. Harley¹ to express the opinion that “we unhesitatingly conclude that enteric fever is often a part of intermittent fever, and the converse.” The Indian records before the time of Scriven—and even since enteric fever has been recognized in India—show this difficulty clearly. Malaria may cause a continued fever with diarrhoea and intense prostration; and enteric fever, as Murchison pointed out, may show remissions in its temperature chart, or put on the intermittent type at the commencement in malarious countries.² When, therefore, we come to deal with a disease intermediate as regards its symptoms between remittents and enteric fever, the difficulty of diagnosis is increased, especially when all three diseases exist side by side. An example of this difficulty occurred on board H. M. S. *Alexandra*, on the Mediterranean Station in 1879, where there was a case, the diagnosis of which was attended with uncertainty till after its fatal termination, when the post-mortem examination “revealed such enteric disease as could only be attributed to the typhoid poison, viz., ulceration of the solitary glands and of Peyer’s patches with perforation of the bowel; yet the symptoms of this case during life differed very slightly from those of others in which these pathological changes were entirely wanting.”³ I shall not attempt to give any points to distinguish typhomalarial fever from malarial fevers (as those who consider it a subdivision of enteric fever would be obliged to do), for I consider it a malarial fever, to which a special interest attaches, from its symptoms simulating enteric fever, though its etiology and pathological result are different.

The real question is, How are we to distinguish it from enteric fever? and that is the main difficulty. We must not forget that enteric fever can be modified by malarial complications—what I propose to call “malarial enteric fever”—and that this increases our difficulty in discriminating between them. The chief modifications in the course of enteric fever produced by malaria are as follows: A prolongation of the incubation period (as was seen after the Egyptian and Soudan campaigns—for in some of the fatal cases among those referred to on page 401, the Peyerian ulcers of enteric fever were found); variations in the temperature curves, such as a wider daily range, marked intermissions or regular remissions, and a lengthening of the febrile condition, or more protracted convalescence. Typical ague attacks have occurred in the course of enteric fever.⁴

¹ Reynolds’s System of Medicine, 1866, vol. i. p. 604.

² Bartlett: Fevers of the United States, 1856.

³ Naval Medical Report, 1879, p. 27.

⁴ A. M. D. Reports, 1880, vol. xxii. p. 96.

How then shall we distinguish typhomalarial from enteric fever? The onset in both is similar, though sometimes more sudden in the former.

I should consider that though the absence of rose spots does not negative enteric fever, their presence, if they could be recognized with certainty, would exclude typhomalarial fever. Murchison¹ considers the spots the only sign by which enteric fever can be diagnosticated from remittent fever in some cases. Persistent and uncontrollable bilious vomiting, especially if commencing early in the illness, is in favor of typhomalarial fever, though, of course, vomiting may occur late with extensive ulceration in enteric fever. The greater frequency of vomiting in typhomalarial fever probably depends upon the more frequent implication of the duodenum and higher parts of the alimentary tract in the morbid process. The character of the stools may assist diagnosis if they are greenish or dark colored; but in both diseases they may have the ochre color common in enteric fever evacuations.

When the duodenum and upper parts of the intestine are chiefly affected in typhomalarial fever, the abdominal pain and tenderness will be most marked in the epigastrium, rather than in the right iliac region. Hemorrhage from the bowels occurs in enteric fever, during separation of the sloughs in the intestine, and epistaxis may also occur in the early stage of the illness. In typhomalarial fever hemorrhages may occur at any stage; and from the bowel (which would appear to be a not uncommon occurrence), from the mouth, nose, or urinary organs.

Pyrexia. In the course of the illness the temperature chart will often give a guide to the nature of the disease. The typical temperature chart in enteric fever is well known, and in a simple, uncomplicated case there would be little doubt as to the diagnosis. Speaking generally, the fever in typhomalaria would seem to run up more quickly, and become high earlier in the illness than would be the case in enteric fever. Its course would not be so uniform, and the daily range is greater in the former.

While at Suakim, Surgeon-Major Cotter mentioned to me that he had observed in India that, whereas in enteric fever the highest temperature of the day occurred in the evening, the daily acme of malarial fevers was usually about noon. My few observations led me to believe that this is not a constant occurrence. The delirium of malarial fever is said to come on earlier in the illness than it usually does in enteric fever.

It will be noticed that my points for diagnosis are mainly those recognized as helping to distinguish malarial fevers from enteric. These points of difference are more fully detailed by Sir Joseph Fayrer in his "Croonian Lectures,"² by Dr. J. Harley in Reynolds's *System of Medicine*,³ by Dr. Russell in the *Epidemiological Society's Transactions*,⁴ and by Dr.

¹ Murchison : Continued Fevers, 3d edition, 1884, p. 597.

³ Art. Enteric Fever.

² Op. cit.

⁴ Epid. Soc. Trans., vol. 4, part iv.

Lyon in the *Indian Annals of Medical Science*,¹ to whom I would refer those who would pursue this subject.

PROGNOSIS.—The immediate danger to life is probably no less than in enteric fever. Convalescence will generally be very much prolonged; and after-effects, such as follow malarial fevers in general, may be expected.

TREATMENT.—In the earlier stages, caution will suggest as strict a *liquid diet* as is necessary in enteric fever. When diagnosis has excluded the latter, and symptoms point to an absence of inflammation of the alimentary canal, a return to solid food may be permitted earlier, and with more safety, than in enteric fever.

Whereas in enteric fever aperients are contraindicated, there would seem to be some reason for giving a *mild aperient* in the early stages of typhomalarial fever, with congestion of the duodenal mucous membrane, and, possibly, also of the stomach. *Quinine* is the most important drug, and may be said to form a necessary part of the treatment. In enteric fever it will do no more than reduce the temperature, in typhomalarial fever it may check the disease.

Some would recommend us to observe the effects of quinine as an aid to diagnosis; but diagnosis should lead to treatment, not haphazard drug-giving suggest a diagnosis.

Stimulants will often be required, and are essential in prolonged and adynamic cases.

A most important aid to cure, when it can be carried out, is to get the patient away from the malarious district as soon as possible. This will sometimes give a chance of recovery in cases which would otherwise be hopeless.

I have tried in this paper to bring together the observations of many who have described what I understand to be typhomalarial fever, and so to draw up a systematic, and, I hope, fairly complete description of the disease.

I must again reiterate my opinion that typhomalarial fever should be considered a malarial disease, and absolutely distinct from enteric fever in its etiology and pathology. Its claim to be distinguished by a special name lies in the fact of its symptoms simulating so closely those of enteric fever.

If the review of the subject here presented does anything to hasten the clearer understanding of what is signified by the term, and of what cases ought to be described as typhomalarial fever, it will have justified the preparation of this paper.

¹ Typhoid Fever Discriminated from Remittent Fever Indian Annals Med. Sci., No. 23, 1871, p. 241.

WAKING-NUMBNESS:¹ A HERETOFORE UNDESCRIBED NEUROSIS.

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Six years ago the following case came to my notice, and I have had constant opportunity to observe it since:

CASE I.—A gentleman, forty-three years of age, in perfect health, and very actively engaged in professional work, experienced every time that he awoke from sleep a sensation of numbness in the ulnar distribution in each hand. The sensation exactly resembled that which results from pressure upon a nerve, and with which we are all so familiar, when, as we say, the foot goes to sleep. But it was soon observed that motion, sensation, and the tactile sense were entirely unaffected, while in the case of pressure upon a nerve, all these functions are suspended. The condition occurred independently of posture and of any other circumstance, save the essential one of waking out of sleep. If the patient dozed a moment in his chair, the peculiar sensation was sure to be present when he awoke.

For some months the numbness or tingling was confined to the little finger and the ulnar side of the ring finger, but gradually it spread over the whole of both hands, then up to the elbows, and finally reached the shoulders, and overspread the upper part of the thorax. Next, the tip of the tongue became affected, and in the course of two or three years the lips were included. Since then there has been no further progress; on the contrary, for the last year and a half the shoulders and chest have been exempt. The period during which the patient is conscious of the sensation does not exceed a minute. He thinks that for some time past it has been absent very frequently, but he has become so accustomed to it that it may pass unobserved, unless more than usually intense.

Quite often a position is assumed during the night in which the ulnar nerve is compressed. The opportunity is then afforded of contrasting the two conditions. In the ulnar distribution there will be paralysis of motion and sensation, and the tactile sense will be lost; while in the rest of the hand these functions will be intact. The feeling of numbness, however, will be uniform throughout the hand.

I have been able to collect three cases of this affection, besides the one described above. One was in my own practice, and the others in the practice of friends, to whom I am indebted for the histories. The second case in my own practice occurred in the person of a type-setter, forty years of age, who came under my observation November 5, 1886.

CASE II.—No history of syphilis, rheumatism, or the alcohol habit could be obtained. Was well until five years ago, when, on waking one morning, he found himself partly paralyzed in the right arm and leg.

¹ A convenient name for this would be *narkophypnia*; *ναρκη*, numbness; *αφυνύω*, to awake.

There was also some thickness of speech, which, however, soon disappeared. The paresis continued, and two years later was followed by a similar attack affecting the left side and the left half of the face. This attack was accompanied by intense abdominal pain and severe constipation, and was followed by oedema of the right leg. The paresis still continues, being most marked in the right leg. He drags the right toe in walking. He is cachectic and badly nourished, and there is a blue line along the gums. Has had several attacks of lead colic. The patellar reflex is diminished on the left side, and slightly exaggerated on the right. Umbilical reflex normal on the left side, absent on the right. Cremasteric absent on the left side, normal on the right. Plantar reflex exaggerated on the left side. Electro-muscular contractility everywhere normal.

Patient complains of a sensation of numbness or tingling in the fingers of both hands on awaking out of sleep. There is no impairment of motion, and he can appreciate the qualities of the bed-clothes, for example, by the sense of touch, as well as ever. There is no change in the appearance or temperature of the fingers. The sensation is always present on awaking, even if it be only from a short nap in the daytime. It passes off in the course of one or two minutes, without having recourse to rubbing or other means for its removal. Occasionally it is felt on the left side of the face and neck. The patient is an intelligent man, and his statements are very clear and definite.

The next case is furnished by Dr. S. H. Hunt, of Long Branch, N. J., and I will give it in his own words:

CASE III.—Miss G. S., æt. twenty-five years, had, in August last, a severe attack of malarial dysentery, which lasted for one week, producing great emaciation and prostration. After a few weeks her recovery seemed complete, and she was able to perform her accustomed household duties. In the last week of November I was called to see her on account of a numbness of the right arm, which occurred only on her waking in the morning. It was referable to the ulnar side of the arm, and she complained mostly of those parts which received the terminal branches of the ulnar nerve. She stated that she had noticed it for the previous two weeks. There was no loss of motion or sensation, or of the tactile sense. It seemed to commence in the extremities of the fingers, and extended up the arm. She commenced rubbing her hand and forearm on waking, and this condition often lasted an hour or two. Knowing her previous history, and suspecting it might be attributable to malarial toxæmia, I gave her antiperiodic doses of quinine, twenty grains daily. On the first night she awoke at midnight, and said the sensation occurred at that time, but was very slight. On the repetition of the dose, there was an entire absence of the sensation, which led me to believe I had found the cause of the trouble. Much to my chagrin, there was a recurrence of the numbness on the third morning. Quinine, iron, and strychnine were then given as a tonic, but the sensation was persistent and obstinate for another week. This tonic, with a change of climate and absolute rest, ultimately gave her relief, and the peculiar numbness disappeared with her general improvement. Up to this date, January, 1887, there has been no return of it. The arm "being asleep," from the position in which it is placed, is a frequent occurrence, but this sensation at

waking, and lasting so long, has led me to inquire what is the *cause* or condition that gives rise to it.

The next case occurred in the practice of Dr. S. H. Burchard, of New York, and is furnished to me by his associate, Dr. H. A. Mandeville :

CASE IV.—Mr. B. W. B., fifty-three years of age. Patient is now suffering from partial paraplegia dependent upon chronic myelitis. About six weeks ago patient began to complain of sensation of general numbness upon first awakening in the morning, which lasts until after free muscular movements of the body, when it gradually passes off; if the patient falls asleep again he experiences the same sensations, which are relieved in the same manner. During these attacks he has absolutely no loss of power; his common sensation, as well as his tactile sense, is perfectly normal. Urine contains a large quantity of oxalate of lime, and is highly acid, otherwise normal.

The patient has been in the habit of sleeping with his head very low, and, thinking that the numbness might be due to an impeded cerebral circulation, it was suggested that he sleep with his head higher. This was accordingly done, with relief to the more prominent symptoms in a few days, but he still complains of the numbness on first awakening.

From a study of these cases it is apparent that the numbness is something added to the normal condition, while nothing is subtracted from it. It is a purely subjective condition. There is no paralysis of motion or sensation, the tactile sense is unimpaired, there is no change in the temperature of the affected part, the surface is not blanched or mottled, there is no tenderness on pressure. These characteristics separate this condition widely from those known under the names of night-palsy, local asphyxia, *digiti mortui*, Raynaud's disease, erythromelalgia, and from the various paræsthesias and acroneuroses heretofore described.

Doubtless the conditions upon which the numbness depends are present during sleep, but the sensation is not sufficiently strong to arouse the sleeper, and he first becomes conscious of it when awakened by some other cause.

The cause of this condition is probably central, since the effect is usually symmetrical. It would seem to be connected with the lowering of the circulation which takes place during sleep, and to disappear when the circulation returns to the waking condition, whether the return be spontaneous, or the result of rubbing, etc. As to the latter, it is doubtful whether it has any other effect than that upon the general circulation which the muscular exertion would necessarily produce.

As for treatment, in the only case in which the condition existed by itself, and independently of more serious conditions, ergot, digitalis, strychnia, and aconite were tried at different times, but without result. The inconvenience produced by the affection was so slight, that no treatment was carried out efficiently, so that even these negative results were of no value. In each of the other cases there was a diseased condition

present, to which the numbness was subordinate, and which afforded the indications for treatment. In proportion as the treatment of the underlying condition was successful the numbness disappeared. If it be true that the cause is central, no local treatment is likely be of service.

A CONTRIBUTION TO THE MANAGEMENT OF
GENERAL ATROPHY (SCLEROSIS?) OF THE CONDUCTING
APPARATUS OF THE EAR.

By S. O. RICHEY, M.D.,

OF WASHINGTON, D. C.

WHEN discussing the nature of this affection in the *Archives of Otol.*, vol. xv., No. 1, 1886, attention was called to the fact that local stimulation, applied immediately to the diseased tissues, promises the most efficient results yet obtained, but no attempt was made to elaborate the details of management, or to describe the means of producing the desired effect in this peculiar region, difficult of approach, sensitive to and resentful of the presence of instruments and medicaments to which it is unaccustomed, and located so near the centre of the senses that many unexpected manifestations of their displeasure occur, which, though merely functional and temporary, are very disagreeable while they last. The necessity of repeating the manipulations and applications for a long time divests the procedure of any sentimental impressions it might otherwise leave. In the ratio of the rapidity of the increase of the impairment of hearing may we find an indication as to the length of time requisite for its proper treatment; for, the slower its progress, the more firmly will the disease changes have established themselves, and, therefore, the more difficult, and the longer the time necessary to remove them.

Empirically repeated incisions of the membrana tympani may, by the contraction of their cicatrices, restore the membrane to a *shape* more nearly normal, but what will be the ultimate effect of this scar-tissue? May it not be worse than the condition it was devised to relieve?

No good reason, based upon pathology, is given for such interference, and I am convinced no thinking man will advise such a course, without a better reason than any yet advanced in its favor. An air-douche to the middle ear, unaccompanied by any other agent, is questionable therapeutics: it is a mechanical shock to a sick organ to be resented sooner or later; generally, at such a time that no connection can be traced.

Depressions of the membrana tympani, alteration in its translucency, thickening of its tissues, and the appearance suggesting adhesions are

probably due to changes in the mucous layer of the membrane and that lining the cavity.

Division of the tensor muscle, the use of Siegle's otoscope, forcible inflation, etc., have been resorted to for the purpose of relieving these features, often with the hearing improved to some degree after each, only to relapse into a worse condition with less prospect of improvement than before.

More frequently a flapping drum-head results, with pain and dizziness when blowing the nose, if there is not stenosis of the Eustachian tubes. The writer has often seen this condition following the too free use of the Politzer or the Valsalvan method of inflation, and generally in the ear not intended to be treated. With gentleness and care this misfortune may be corrected, but forms a long and tedious introduction to the necessary treatment of the original affection, when it happens to an ear already diseased, though it could be avoided by prudence in the beginning.

Too much stress is laid upon the fact that a drum-membrane is depressed, except as an evidence of the affection behind it, and producing it, the improvement of which establishes the proper position and condition of the membrana tympani in a perfectly natural way, by a removal of the cause: just as a pannus may often be cured by treating the conjunctivitis.

The morbid process in the cases under discussion does not, to our knowledge, cause death, and hence our opportunities are limited for completing their history by an autopsy, after close observation during life; and in this way only can the question be definitely settled; but it is not my impression that depression of the membrana tympani is so frequently due to retraction of the tensor muscle, or to adhesions to the inner wall of the cavity, as has been supposed, but, reasoning clinically, to shrinking of the mucous layer of the drum-head from atrophy, which slowly involves the whole membrane. The membrana tympani has, moreover, been seen to change in this feature, and in translucency, with the improvement from dryness and atrophy in the middle ear cavity, and that without special *force* from within. With the change in the mucous membrane toward health is associated a tendency of the membrana tympani to resume its natural and original position, and the less the solution of continuity of tissue has been in the membrana tympani, the better it should perform its function.

How much are we indebted to an atrophied condition of the conducting ear, for that variety of tinnitus, due, probably, to anæmia, which begins before there is any other prominent symptom of disease; which increases slowly, is very intractable, and often is not relieved until long after the hearing is improved? When this tinnitus is dependent upon disease of the naso-pharyngeal space, it is variable; that is, it is heard

sometimes in one ear; again, in the other; and, at another time, in both. It is relieved by restoring in the nasopharynx the natural relations for resonance.

Is persistent tinnitus in a given ear, when cerebral, circulatory, or nasopharyngeal causes can be excluded, not due to a disturbance in the character of the cavity; its moisture, its tension, form, size, etc.? Does not a modification of this alteration, by a topical application of therapeutic agents, offer us the best prospect of success?

The anatomical peculiarities of the tympanic cavity, its impatience of artificial control, and its resentment of the presence of foreign substances, limit, for the purpose of stimulation, the means at our command.

No *fluid* having this therapeutic value can with safety be carried beyond the isthmus of the Eustachian tubes, the danger being that, reaching the cavity, it will settle in the depressions, and by undue action there cause inflammation. We are thus confined to *vapors* for this purpose, because they diffuse themselves throughout the whole cavity without partiality and affect the entire lining membrane, producing no more influence in one locality than in another; they, at least, do this better than any other form of medication.

Chloroform or *ether* vapors have not been very efficient in my hands; for, while they cause considerable hyperæmia, this as readily passes off, unless so much vapor is used as to make the danger of acute inflammation so imminent that I have not felt justified in persisting with it. By very frequent application in moderate quantity, it might serve the desired purpose with diminished risk, but the object to be obtained is an almost *constant fixed action, an approximately continued influence*, and it is not easy to see how, with this agent, it can be accomplished. The mere odor of either chloroform or ether will cause nausea at once in some individuals, and generally does so with all, sooner or later; another reason for abandoning it.

My intention was to try a vapor of *chloroform* and *turpentine*, but the objections to chloroform were so pronounced, and the dread that the vesicular eruption and obstinate ulceration, which turpentine sometimes produces when applied to the skin, might be repeated in the mucous membrane, has so far deterred me from the experiment, which will probably be left to some one bolder.

Ammonia might be serviceable if it could be confined to the middle ear cavity, but its extreme volatility diffuses it through the pharynx and nares in a most uncomfortable way.

In circumstances of extreme difficulty we are apt to be content with what *has* answered the purpose in our hands, and my reliance has been almost entirely upon the vapor of iodine, with good, though not with uniformly satisfactory results.

The method adopted early in my practice is that which I first saw used

by S. J. Jones,¹ of Chicago, which is a modification and combination by him of several other methods. It differs from the Politzer methods in the substitution of the local anæsthesia bulb for the large bag, and *the use of the catheter*, which should be of malleable silver, as this may be readily adjusted in shape to pass through the nostril and reach the Eustachian orifice, anatomical variations being frequent on even the two sides of the same individual. In addition, being made of metal, it may be sterilized by dipping it in alcohol, and burning it out.

By these means we may be satisfied that the vapor reaches the objective middle ear cavity *first*, though the reflux reaches the air passages, from which it is not always desirable to exclude it; and, when it is, the severity of the application may be limited. The *smaller* bulb may be easily and firmly grasped in the hand, is readily compressible, and a measure of the obstruction of the tube, or of the pressure to which the membrana tympani is being subjected, may be ascertained by the resistance of the bulb to the hand. The light and flexible tubing, between the Buttle's inhaler and the hand-bulb, removes the risk of dragging upon the catheter when compressing the bulb; or of bending or breaking the catheter, as some of the books warn us, in describing the use of the Politzer bag with the catheter. *Hard-rubber* catheters are brittle, and require the aid of heat if a change in shape is desired, and for this reason are cumbersome. Besides, they are unclean, because they cannot be as easily and efficiently purified as can the silver instruments, as above suggested. Some silver catheters are rudely and inartistically made, and can be handled with no more facility than those of rubber, but the delicacy and ease of manipulation which can be acquired with the silver instrument, *properly* made, and the complete security against the danger from inoculation when it has been "purified by fire," add greatly to the comfort of the surgeon, and the comfort and safety of the patient.

The mechanical force arising from the quick *shocks* of air propelled by the hand-bulb has seemed to me as objectionable, only in a much less degree, as those inflicted by the large Politzer bag. The pressure in the middle ear cavity is temporarily very great, and a more steady and less forcible pressure must commend itself to our judgment. This I have secured by means of condensed air, with the aid of the air-pump and receiver ordinarily used by laryngologists in spraying the pharynx and the contiguous regions. With the "cut-off" which accompanies this instrument, we may have absolute control of the air-pressure in the middle ear, and if at any time the sharp impulse of air is desired, or deemed advisable, it is easily secured by this means.

¹ Trans. of the International Medical Congress, Philadelphia, 1876. "Modifications of the Methods of Treating Chronic Non-suppurative Inflammation of the Eustachian Tube and Middle Ear."

In the cases of so-called "*dry aural catarrh*," the Eustachian tubes are usually without obstruction, and a pressure of air sufficient to carry the vaporized medicament into the deep recesses of the ear seems sufficient. In my experience, this can be accomplished with a pressure varying from one-fifth to one atmosphere (three to fifteen pounds). The vapor, during the continued pressure, escapes into the pharynx and nares by the side of the catheter, and the return current meeting the advancing current near the orifice of the catheter produces a slight *rustling* sound, which is perceptible by means of the *auscultation tube*. The impingement of the advancing current of air upon the membrana tympani is also to be distinguished, if it reaches the cavity of the middle ear, by a light *blowing* sound.

It is best to suspend the pressure during inspiration, and to continue it during expiration; in this way avoiding, as much as possible, the extension of the vapor to the trachea, bronchi, and lungs, rendering it less disagreeable, and, with the assistance of the column of air expired, securing a more efficient application to the cavity. Besides, the expiration relieves the pharynx and nasal passages of the presence of the reflux of vapor as it escapes from the Eustachian tubes. A white handkerchief held to the nose has often been observed to be stained by the iodine vapor, which could reach it in no other way.

It has become my practice to *moisten* the sponges only when fitting them into the Buttle's inhaler, for by drying they adapt themselves to its shape better; not afterward, for the *crystals* of iodine evaporate with the air passing over them, as well when the sponges are dry as when they are moist. Constant use of the muscles of the forearm in compressing the hand-bulb is not without its risks to the surgeon, as it may induce morbid growths there; another reason for the use of condensed air.

Finding the hand-pump troublesome and inconvenient, my resort has been a hydraulic automatic air-pump,¹ which, being connected with the aqueduct water, gives a pressure of air equal to the pressure of water in the pipes supplying the house. It pumps air into the receiver as it is being exhausted, and maintains an approximately regular pressure. If the pressure of the water in the pipes reaches twenty to thirty-five pounds, it will be sufficient for all ordinary purposes, as the pump will act until equality is established between the pressure of the air and of the water. It is a great saving of labor and attention. The one in my office is known as "*The Reliance*," and was promoted from its original purpose of furnishing air pressure to beer barrels, to its present use. It is a handsome fixture, and can be obtained from Mr. Harvey, of Wash-

¹ Since the writing of the above and after using the apparatus, I find an account of something of the kind used for experimental purposes. Barth, *Archiv. Otol.*, vol. xv. p. 160.

ington, put in position, for about forty dollars. A metal pipe runs from my receiver (which is on the floor) over my table, and is attached to the wall. This contains several stop-cocks, to which may be attached as many different apparatus for spray; between them and the reservoir is a governor which can be set to give the measure of air-pressure desired. By this last item guessing at the amount of pressure is avoided and accuracy may be secured.

The local application of iodized air will be followed by a feeling of warmth and an increase of secretion from the nares and pharynx, before it is perceptible in the ear by the patient, or before the surgeon can assure himself of its effect upon the ear by inspection. The *feeling in the ear* has been aptly described by a young woman, as "just like when you blush." As the vapor is driven into the ear first, the reflux into the pharynx and nares serves as a measure of the impression being made in the cavity of the middle ear, for, in some instances, it is not possible to produce any sensation in the tympanum, or to derive any information from an examination of the membrana tympani in the early stages of the treatment. In advanced cases of the disease no sensation is caused by the vapor for months; but, from the time it is first felt, there is steady increase in sensitiveness, and the severity of influenza following a sitting. This artificial influenza resembles any other, except that it is self-limited and of shorter duration, continuing from two to eight or ten hours; it is more easily produced and lasts longer as the treatment progresses. The use of the vapor has not, under my observation, occasioned anything resembling general iodism.

As it is needful only to maintain a state of hyperæmia as continuous as possible, the intervals between the interviews may be lengthened with the time the effect persists. Increased impairment of hearing and aggravation of any existing tinnitus may occur during the first week of treatment, and this naturally would not be unexpected in a state of tissue-thickening, a result of the hyperæmic condition of the membrane. It is apt to be alarming to the surgeon, unless he has had one experience or more; to the patient it will be disheartening, unless he has been previously advised of its probability, although it has not been observed in all cases. Why it should happen in some instances, only, is not clear, and the percentage of cases in which it does occur has not been ascertained. That it is due to congestion is proved by its occurrence each time the treatment is begun, after an interval of rest, and by the relation it bears to the intensity of the congestion. An improvement in these symptoms, corresponding in extent to their aggravation, takes place upon a discontinuance of the manipulations, which is noticeable in a month, or less, afterward, if the treatment has continued for several months.

If improvement takes place during the use of the vapor, this will be

increased, as indicated, after its suspension. Thus, generally, a gain can be decided only after a rest, which will not interfere with the ultimate result unless it lasts too long.

If the applications be too severe, or if the effect be increased by exposure to draught, or otherwise (and individuals vary greatly in liability to this accident), I have been able, with one exception, to control the resulting inflammation, by pressing against the membrana tympani a tampon of "prepared cotton," the end of which, in contact with the membrane, has been saturated with a solution of argenti nit. 1 : 100 parts. This, done early, often gives as immediate relief from pain as an anæsthetic. It should be left in position for some hours. The astringency reduces the local hyperæmia, and the tampon supports the membrana tympani and prevents its motion during the act of swallowing, or blowing the nose. The patient should be advised of the possibility of the accident, how best to avoid it, and to see the surgeon immediately when it occurs.

Iodized cotton in the external meatus is another means of using iodine. "Prepared" cotton placed in a closed vessel with crystals of iodine absorbs iodine, and parts with it again in the meatus. That this produces the symptoms, hyperæmia of the membrana tympani and external meatus, with some itching of the meatus, is proved in cases where the cavity is exposed by a perforation of the membrana tympani, as pain will result (though not when the drum membrane is entire) and will be relieved by removal of the cotton. The vapor applied to the cavity causes, in time, itching of the meatus in those cases which do well, and this fact induced me to use the iodized cotton in the meatus for its possible effect on middle ear nutrition, and that of the dermis of the meatus and the underlying glands. This application to the meatus is cleaner and more manageable than others, though it may be an advantage to substitute for it, sometimes, the ungt. hydrarg. nit. (pure, or mixed with lanolin in quantity varying to suit the condition), to the dermis. It is not in my power to say how much these aid the case, having never relied upon them alone in any instance, but they do service when the meatus is dry and exfoliating.

Electricity may serve to improve regional nutrition, as it does in trigeminal neuralgia, if a galvanic current be passed from the inferior cervical ganglion to the external meatus and to the Eustachian orifice, the difficulties being the time on the part of the surgeon required for each sitting, and the uncertainty of the result, for it would have to be tried alone to reach a decision as to its value.

To select a proper subject for this purpose, and to do it justice in respect to the individual and the agent both, is not a question of a short time. My reliance upon electricity, in controlling the action of the vasomotors of the region supplied by the branches of the fifth nerve, is

decided. In none but subacute cases has my observation, however, led me to think it acts promptly, and though my limited experience of its influence in cases of atrophy is not satisfactory, yet it is my hope at some future time to make more exact and reliable statements concerning it. Where stenosis of the inferior nasal strait exists, *electrolysis* accomplishes more than any other agent, except, perhaps, thermocautery. If a small silver catheter can be introduced at all, if not, a silver probe will make an excellent conductor, and with one pole at the nape of the neck, and the probe converted into the negative pole, absorption of morbid material may be caused, sufficient to admit the passage of a small catheter at a second interview. The current need not be strong enough to cause much pain. Absorption seems to continue for from a week to a month. Whether absorption of bone-hypertrophy takes place, I cannot yet say. Mayhap some further advantage would arise from the substitution of needles inserted into the diseased tissue, under the influence of cocaine, and electrolysis tried through them. It is a decided gain to avoid the *removal* of any essential part of an organ.

The use of the *steam atomizer*, in preparing the mucous surfaces for the action of the vapor, unnecessarily consumes the time of the surgeon and his client, without compensating advantage, as the stimulation by the vapor increases the quantity and fluidity of the secretion, and accomplishes the same purpose.

A spray *through the catheter* to the pharynx and posterior nares, and even into the Eustachian orifice, of argent. nit., 1; acidi borici, 7; glycerinæ, 20; aquæ, 500 parts, gives admirable results, when astringency is desirable. Unless forced into the superior meatus of the nares, or beyond the isthmus of the Eustachian tube, it is painless.

In this paper, discussion of the hygienic management is beyond the consideration.

A surgeon who is not full of courage both for himself and his client, who is afraid of labor, or who cannot persist patiently without seeing positive and rapid tissue change, should not undertake this class of cases, for the results cannot be brilliant in the length of time required, nor in their impression upon the ignorant, but are important chiefly to those who suffer. After a spasmodic, which always means an unsuccessful, effort, the difficulty is increased by the additional discouragement to that usually felt by these people. The object is not to claim anything miraculous even in appearance, but to make a decided statement that *all* these cases are *not incurable*, even when far advanced. The condition, the course of treatment necessary and its annoying accompaniments, and the possible expense, should be contrasted with the probable outcome if the disease is neglected, and the individual should be left to decide for himself what he should do. He will often conclude to take the chance of relief, thinking he will persist, but growing weary of the slow im-

provement he may give it up. This, in a measure, is his own affair; but, with this possibility in view, the surgeon does not feel very desirous of the responsibility, though he may have the satisfaction that he has done right in so far as he was permitted. I have never seen an instance in which there was not an amelioration of one or more of the symptoms after a time; a better feeling about the head; an improvement in conscious mental vigor, or in the memory; less tympanic neuralgia, or less tinnitus; increased ability to sleep, which is more refreshing; or an improvement in the power of hearing. In the event that the hearing is not improved, the surgeon, unfortunately, has only the consciousness of duty performed, as the better condition being confined to the patient himself, and not being perceptible to his friends, there is no credit to the surgeon, because the individual "did not get back his hearing." The organ is beyond the vision of all interested, except the medical adviser, and no one appreciates the influence of the *subjective* disturbances, except the physician and the patient, or realizes what relief from them means to the sufferer. The patient's friends, with the best intentions, are, in fact, because of their ignorance, his worst enemies, and a stumbling-block in the path of the surgeon, for they will, by united effort, sometimes convince the patient, contrary to his better knowledge, that there has been no change, as any advantage is so slowly gained that they become accustomed to it. Not infrequently the patient will say, "If I never hear any better, it is worth all the time, expense, and trouble to be relieved of the confusion and weight I have had in my head." One individual said some time ago, that "he would be glad to continue the treatment once a week for the rest of his life for this effect alone, as it had, for some years, been growing more difficult to do brain work, and he thought he must soon give it up." He was one of those who could hear only a loud voice in a moving car, or a din of some kind; a condition which we know to be very intractable. He now hears the ordinary conversational tone three or four feet distant in a quiet room.

This affection is one of such importance to so many people, interfering with their usefulness to society, their personal comfort and happiness, and the convenience of those brought in contact with them, that all knowledge in regard to it repays the endeavor. A faithful consideration of my contribution will prove it rational and in the right direction, so far as it goes, and it is hoped my *confrères* will give the patient attention and trial that the establishment of a reliable means of relief from this disease would deserve. Whatever this means may be, it cannot be speedy in face of the character of the disease. The treatment described unquestionably relieves *some* cases; it has been serviceable to nearly all for whom it has been tried. If some exist who would derive no benefit from it, *why not?* This is an important question, and it may be properly answered, that the trial was not long enough continued.

We must bear in mind that in all these cases the individual, or his friends, have been aware that something was wrong for years, and, knowing its rate of progress after the disease manifests its presence, we may confidently reason that it had been existent a very long time before that, so to impair the organ as to produce troublesome symptoms. A proportionate time and effort must be given to its relief. We patiently and persistently treat a chronic conjunctivitis and its sequelæ, and are encouraged to continue by our observation of the structural changes resulting from our efforts, and we must be guided and encouraged in the same way while attempting to improve this condition. We cannot rely entirely on restored function as evidence, for these people are more miserable than the blind, when they become profoundly deaf, without the element of maddening tinnitus which is so often present, and which so wears on the physical strength and the mental equilibrium, ceasing neither day nor night, that it must be an important factor in the causation of insanity and suicide. From a humanitarian view the result striven for is great, and any one who has even temporarily suffered in this way can appreciate what it must mean to be without hope of relief—*incurable*.

BACTERIOLOGY.

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(FOURTH PAPER.)

OF the methods of investigating bacteria, there are three that are most important, viz.: (I.) The study of their characters by the aid of the microscope; (II.) their investigation by means of cultivation; and (III.) the study of their relation to the living body. The chemistry of their products is also very important, but the methods of chemical analysis can be found in works on chemistry and need not, therefore, be detailed here.

I. MICROSCOPICAL INVESTIGATION.

It is unnecessary to go into details as to the construction and the theory of the microscope, but I may mention the chief practical points in using it. The objects being minute and delicate, accurate illumination and fairly high angled lenses are necessary.

The lenses required are a low power ($\frac{1}{2}$ inch) for adjustment, an intermediate power ($\frac{1}{4}$ or $\frac{1}{8}$ inch) to get a general view of the relation of parts, and high powers for exact examination. Of the high powers, the

oil immersion lenses are the best, for two reasons: in the first place they are high angled and give a good picture and more light, and in the second place an adjustment collar is not absolutely necessary, and thus much time and trouble are saved. For most purposes $\frac{1}{12}$ oil immersion is sufficient, but $\frac{1}{18}$ and $\frac{1}{25}$ may also be obtained. The latter lenses not having, as a rule, such a high angle of aperture as the $\frac{1}{12}$, do not really show more detail; they merely show the objects larger.

Dry and water immersion high power lenses must be provided with a correction collar which enables the front and back lenses of the combination to be approximated or separated according to the thickness of the cover-glass; and, as cover-glasses vary much in thickness, the lens must be corrected for every specimen. In correcting a lens a high eye-piece must be used so as to magnify the defects as much as possible. Some delicate object is fixed, such as a delicate line, a group of granules, etc., and the collar is moved in one direction till it is evident that the picture is becoming worse; it is then moved in the opposite direction till the same thing happens, and so backward and forward in gradually diminishing distances till at last the best point is determined. In the case of oil immersions, it is well, also, to have a correction collar, for the oil is never of exactly the same refractive index as the glass; but, unless for very fine work, it is not necessary to alter it when the best average position has once been ascertained.

The microscope stand should be very steady and provided with a coarse and fine adjustment. The fine adjustment should work smoothly, slowly, and equably, otherwise it will be a matter of great difficulty to bring the object into accurate focus when using a high power. This is a matter of great importance. In most microscopes where the movement is obtained merely by a screw and a spring, the fine adjustment is imperfect, the parts get dirty, and the spring does not act instantly and steadily; hence the lens shoots past the focal point and exact focusing with very high powers is almost out of the question.

In bacteriological work a mechanical stage is often of great advantage. This is particularly the case where the whole specimen must be thoroughly searched for bacteria, and also where one wishes to find and resume the study, at a future time, of any special bacterium or group of bacteria. For the latter purpose a finder is necessary, the usual plan being that the fixed part of the stage is graduated on two sides and the amount of horizontal and vertical movement is read off. By placing the specimen and the movable stage in the same position, the object will be brought into the field of the microscope. Another very good method is by using a Maltwood's finder. Rotary stage movement is not necessary.

The substage arrangements are of the greatest importance. A wide-angled condenser is essential and it should be, if possible, achromatic. The substage must be provided with a coarse adjustment by which the

condenser may be raised or lowered, and for fine work a fine adjustment in addition is an advantage. There must also be screws for centring the condenser. Rotation of the substage is not necessary for bacteric work. Diaphragms of various sizes are required; one of the best forms of diaphragm being the iris diaphragm, by means of which the amount of light admitted can be varied with the greatest ease.

The proper arrangement of the illumination is one of the most important parts of microscopy, though often neglected by investigators. The first point is to centre the condenser. This is done by using the smallest diaphragm, and, after the specimen is brought into view with the low power object-glass, racking down the condenser till the ring of the diaphragm appears sharp. By means of the centring screws this ring is brought into the middle of the field. Having centred the condenser, use a larger diaphragm or none at all, and rack up the substage till the source of light is sharply in focus at the same time that the specimen is well seen. When working with lamplight it is easy to focus the source of light and to get the flame of the lamp quite sharp, but with daylight it is not so easy. In the latter case it is better to focus some object at a little distance off, such as the branch of a tree, a chimney, etc.—the focus will be almost the same for clouds or sky. The centring of the condenser may require alteration when fresh lenses are used, because the position of the axis of each lens when screwed on to the tube is not always exactly the same. Hence if, when working with lamplight the flame is seen to have moved to one side of the field when a new lens has been put on, do not alter the position of the lamp but bring the flame into the centre of the field by means of the centring screws. When using the higher objectives the condenser can be still more accurately focussed by means of the fine adjustment. The centring of the condenser requires to be done only at the beginning of the day and needs attention only when new lenses are used; the focussing of the condenser must be done for every specimen unless, indeed, slides of exactly the same thickness are used throughout. As the slides are thicker or thinner, so must the condenser be approximated or removed in order to bring the source of light to a focus on the specimen. It is thus evident that good microscopes must have a coarse adjustment for the condenser and also centring arrangements. Those which have the condenser fixed or only sliding, and no centring arrangements, are bad. Oblique illumination is not required in this kind of work.

As to the source of light, we may use daylight or artificial light. Of artificial light the best is a paraffin lamp. Each of these has its advantages. My own opinion is that for high powers lamplight is best; the source of light is fixed and the light can be accurately concentrated on the point under examination, and in this way one can get more light and can apply it more accurately than with daylight, especially if one employs

the edge of the flame, which gives about four times more light than the flat flame. On the other hand, for low power work daylight is undoubtedly the best. It fills the field equally, not being more intense at one part than another, while with lamplight, if the edge of the flame is used, only a narrow streak of light is seen in the centre of the field and a general survey cannot be easily obtained, while at the same time the illumination at the one point is too intense. It must be remembered that in using a condenser a flat mirror should be employed.

Very convenient lamps for microscopical work are made by Messrs. Swift & Beck. They consist essentially of large flat reservoirs for the oil. The chimney is a metallic one with a space on one side into which an ordinary microscopic glass slide can be slipped. The chimney can be turned round so that the glass slip may be brought opposite either the edge or the flat flame. The advantages of these lamps are that having a large reservoir they burn for a long time; that the reservoir being flat the lamp can be lowered much more than usual; that the light passes through a flat instead of a curved piece of glass; that the rest of the chimney being darkened there are no reflections; that if the glass breaks a fresh glass is always at hand and that the edge or flat flame can be used at will. The only difficulty about these lamps is that the glass is very apt to break. This may be avoided by selecting a thin glass and boiling it for some hours in water or oil before using it or by turning up the flame at first only very slowly. In using the lamp the light can be reflected into the microscope by means of a flat mirror, or the microscope may be tilted so that the light passes directly from the flame into the tube of the microscope, and this is the more satisfactory method when it can be employed. With lamplight it is well to interpose a piece of blue or neutral tint glass to remove the yellow color and make the light pleasanter to the eye. For this purpose colored glass of various intensities should be at hand.

I may sum up these remarks in the following rules:

1. Use a low power objective and a low eye-piece and place the specimen on the stage of the microscope.
2. Remove the diaphragm and rack up the condenser till it almost touches the slide.
3. Bring the specimen accurately into focus and leave it so.
4. Put in the smallest diaphragm and rack down the condenser till the hole of the diaphragm is sharply seen.
5. Centre the condenser by bringing this hole into the middle of the field. (4 and 5 need not be repeated more than once.)
6. Substitute a larger diaphragm and rack up the condenser till the source of light is accurately defined—the edge of the flame, branch of tree, etc. With lamplight it is best to dispense with the mirror and to place the lamp about eight inches from the condenser.

7. See again to the focussing of the specimen and be sure that it and the source of light are both at the same time accurately in focus.

8. Substitute the high power objective, again focus the specimen, and, if necessary, focus the light still more exactly. If the light (edge of the flame) is not quite in the centre of the field, bring it in by means of the centring screws, but do not move the lamp.

9. If the objective is a high dry power or a water immersion, it must now be corrected for the thickness of the cover glass. To do this, substitute a high eye-piece for the low one, and move the screw collar alternately in one or other direction till the sharpest picture is obtained.

The centring of the condenser (4 and 5) need only be done when one sits down to use the microscope, but the focussing of the condenser and the correction of the lens must be repeated with every new specimen. At first sight it may seem irksome to do this, but very soon one learns to do it quickly, and the gain in clearness, definition, and satisfactory examination of the specimen amply repays all the trouble.

In the investigation of bacteria the microscope is used for the examination of unstained and stained specimens. Of these the most valuable are the stained specimens, but as this involves the death of the organisms it is often necessary to study them without staining in order to see their normal form and structure, and to ascertain their characteristics, especially as regards the power of movement, mode of growth, grouping, etc.

A. UNSTAINED SPECIMENS.—In examining unstained specimens it is necessary to cut off a large amount of light by means of diaphragms, but the other arrangements of the microscope in respect of focussing and centring the condenser must be carried out in the manner just described. The bacteria to be examined without staining may be present in sections, or growing in fluid or in solid cultivating media.

It is but rarely nowadays that one examines bacteria in sections without staining them, but this was the method chiefly employed before the affinity of these organisms for the aniline dyes was discovered. In the unstained condition it is often difficult to distinguish the micro-organisms from the tissue elements, and in order to do this with some degree of certainty the section is washed in acetic acid and then mounted in glycerine. Bacteria resist this treatment, while fatty and other materials are acted upon, and hence if groups of well-defined granules, all of the same shape and size, or of rod-shaped bodies are seen, they are in all probability microorganisms. Baumgarten succeeded in demonstrating the tubercle bacillus about the same time that Koch published his first paper on the subject, by subjecting sections of tuberculous tissue to the action of weak caustic potash; the tissue elements became invisible or less visible than usual, while the bacilli stood out markedly, having resisted the action of the alkali.

In examining pure cultivations of bacteria in fluids or solids, care must be taken not to let foreign bacteria into the cultivations from which the specimens are taken. The fluids may be obtained by using a thin platinum wire fixed in a glass rod and twisted into a loop at the end. The whole of the wire as well as the lower part of the glass rod must be carefully heated in the glass flame; when cool it is dipped into the flask, and a little of the fluid is picked up in the loop of the wire. Portions of fluid may also be removed by means of a sterilized pipette, the vessel containing the cultivation being held obliquely and the movements performed rapidly. Or, still better, a syringe may be employed, to the end of which a bent piece of glass rod is attached by India-rubber tubing; the glass rod is sterilized and introduced into the flask and a small quantity of the fluid drawn up by means of the syringe. If a small syringe with a ring at the end of the piston be employed, the whole manipulation can be done with one hand, the syringe being held in the hand and the piston withdrawn by means of the little finger passed into the ring.

The drop obtained by one or other of these methods may be examined by simply placing it on a slide and dropping a cover-glass on it. In this case care should be taken to have an air-bubble under the cover-glass, for it is often very difficult to focus a thin layer of fluid, while the margin of the air-bubble is easily defined and thus leads to the layer. This method is not sufficient if the examination is to be continued for some time, because evaporation occurs readily and also because there are very apt to be distracting currents, especially if an immersion lens be used. To avoid these inconveniences it is best to use cupped slides or glass cells. A small drop is placed on the middle of a large cover-glass, a little vaseline is put round the side of the cup or of the cell, the slide is turned upside down and dropped on the cover-glass so that the drop is in the centre of the cell, very slight pressure diffuses the vaseline and makes the cover-glass stick to the slide, and the slide is then quickly turned up so that the cover-glass is on the top with the drop hanging from its under surface. Where the observation of the drop is to be continued for some time, as where the mode of growth, spore formation, etc., is to be watched, the slide and cover-glass should be sterilized in the flame and the manipulations performed as quickly as possible. With regard to the cover-glass, care must be taken in passing it through the flame that it does not get too hot, otherwise it bends and does not lie flat on the top of the cell. If it is necessary to keep the cultivation, while under observation, at a temperature above that of the air, one or other form of hot stage must be employed instead of the cupped slide; but as the methods of using these are described in all books on microscopy, I need not go into that subject here.

Where the bacteria are growing on some solid material, a minute

quantity is picked up with the sterilized needle and diffused in distilled water, salt solution (one-half to one per cent.), or cultivating fluid, and examined as above. It may also be necessary to examine bacteria *in situ* when growing on or in solid media, but this will be referred to afterward under "plate cultivations."

B. STAINED SPECIMENS.—The amount of information derived from the examination of unstained specimens is, however, comparatively small, and, therefore, in most cases recourse is had to the various methods of staining. It is only quite recently that satisfactorily stained specimens of bacteria have been obtained. The older attempts at staining were made with carmine and hæmatoxylin, but only a few species take on these stains, and in no case can the result be called good. With Weigert's discovery of the affinity of bacteria for certain of the aniline dyes, the state of matters has, however, been completely altered, and the work of Weigert, Koch, Ehrlich, and others, has led to great advances in this department of bacteriology. In resorting to stained specimens, the investigator may wish to study the bacteria alone, quite apart from their surroundings, or he may desire to ascertain their relations to the elements of the tissues in which they occur. In the former case what are termed "cover-glass preparations" are made; in the latter, sections of the tissue are employed. As the preparation and treatment of these two sets of specimens differ in several important particulars, it will be well to consider them separately.

1. *Cover-glass preparations.* These are employed when one examines bacteria in fluids, or in cultivations, etc., or when one wishes to gain an idea of the presence and probable numbers of these organisms in tissues without studying precisely their relations to the tissue elements. The method consists in spreading out the material in a thin layer on one side of a cover-glass, and fixing this layer to the glass. The material may be spread out by means of a needle, the point of a knife, etc., but the best way of obtaining an extremely thin and even layer is to take two cover-glasses, put a minute quantity of the fluid on the centre of one, drop the other glass on the top of it, press them together so as to diffuse the material over the glass, and squeeze out any superfluous fluid; then, keeping up the pressure, slide them apart and set them up on their edge to dry under protection from dust. They dry in a very short time, but if one wishes to hasten matters, they can be held in the fingers at a considerable distance above a flame; they must not, however, be actually heated while still moist, and by holding the glass in the hand instead of in forceps one takes care that they are not brought too near the flame.

In other cases the material may be too thick to spread out in the manner above mentioned; it must, therefore, be diffused in a drop of boiled distilled water. Where water is thus employed there is always

the difficulty that after the cover-glasses are slid apart the water collects in drops as on a duck's back, and little heaps of microörganisms are obtained. It is therefore better when water is used not to press the drop between two cover-glasses, but to let it dry on one glass. It will be found that while at the centre there will probably be too many bacteria, at the circumference of the drop one will find satisfactory places. This is also the best way of preparing drop cultivations for staining. The cover-glass from which the drop is hanging is turned over and the fluid allowed to dry. Where the material is very dense, as, for instance, a small tubercle, it is best to crush it well between two knives and then rub the crushed mass over the surface of a cover-glass, afterward removing the superfluous solid material. Lastly, we have what the Germans call "Klatsch" preparations, which are made in the following manner: As will afterward be pointed out, it is often important to study the mode in which various organisms spread over the surface of solid materials. When growth has occurred to some extent, a cover-glass is dropped over the spreading part, pressed lightly, and then lifted. The cover-glass picks up the bacteria, and when the specimen is dried and stained, one gets an exact impression of the mode of surface growth of the organism in question. These "impress preparations" are often very beautiful and valuable.

Cover-glasses prepared in any of these ways can be kept in a dry place for a long time without undergoing any change or losing their property of staining, and it is often necessary to keep a number of specimens of the same material either for future reference or for trying new stains or testing the activity of staining fluids which may have yielded negative results with other specimens. This is especially the case with tubercle. The stain ordinarily used for staining tubercle bacilli is very apt to go bad in a few days, and, therefore, I always keep a number of prepared cover-glasses of sputum or other material rich in tubercle bacilli at hand, so that if a negative result is obtained I can stain one of these glasses and see whether the result is due to some fault in the stain or to the absence of bacilli.

A layer having thus been obtained, it must be fixed before proceeding with the staining. If the layer contains albumen, the albumen is not coagulated by simple drying and, therefore, when placed to stain in a watery solution the albumen dissolves and the layer becomes detached. And even if any portion of the layer remains, that is not of much use, as precipitation of the stain occurs in connection with the albumen. It is, therefore, necessary to coagulate the albumen before proceeding with the staining and at the same time to retain for bacteria and nuclei their power of taking up the dye. This was done by Koch at first by placing the cover-glasses for some days in absolute alcohol. But this is a tedious method and one of the great advantages of these cover-glass prepara-

tions is that they can be prepared and stained in a very short time. Ehrlich found that if cover-glass specimens of blood were kept for an hour at 100° C. to 115° C. the desired coagulation was obtained without interfering with the staining of the nuclei, etc. Koch has applied this method to bacteric work, and at first recommended placing cover-glasses for an hour in an iron chamber kept at about 110° C. Ehrlich's method is simpler. He takes a long strip of metal, supports it on a tripod, and places a Bunsen's burner under one end. After about a quarter of an hour a wet rod is drawn over the metal from the cool end toward the flame. At a certain point it will be seen that the water boils. That line is, therefore, at 100° C. and its exact position is carefully ascertained. Cover-glasses with the coated surface upward are laid on that line or a little nearer the flame and kept there for an hour. As the best temperature varies for different materials, it is easily ascertained by using three or four cover-glasses and laying them at slightly different distances from the flame. One of them will be good.

Where one wishes to obtain really beautiful specimens for preservation the above is the best method, but it has been found that sufficiently good specimens are obtained by seizing the cover-glass in a pair of forceps with the spread side upward and passing it fairly rapidly three times through a glass flame (about as rapidly as one cuts bread—Rindfleisch). If it is passed too often through the flame, or if it is heated too long on the metal plate, the bacteria lose their property of taking on the stain.

Having thus prepared the specimens they must next be stained. This is much easier to do in the case of cover-glass preparations than in that of sections, but different kinds of bacteria stain differently. One of the most satisfactory stains to use is a fairly strong watery solution of methyl-violet. I do not make it up on any precise formula, but add a stock saturated alcoholic solution of methyl-violet to distilled water till a deep color is obtained. I should guess that the proportions are about one part of the methyl-violet to ten parts of water. A few drops of this are filtered into a watch-glass and then the cover-glass being held between the finger and thumb with the covered side downward, it is dropped on the stain and allowed to float there for five or ten minutes. It is then removed and washed repeatedly in dilute acetic acid (one-half to one per cent.) till no more stain comes out. It is afterward rinsed in distilled water and examined in the water. If a permanent preparation is required, it is then dried in the air and when quite dry is mounted in Canada balsam. If it is dried at a high temperature, the stain disappears and this is the case with all stained specimens; they should not be heated after staining. The specimens should always be examined in water in the first instance, because there the bacteria swell out to their natural size (more especially when acetic acid is used), whereas they dwindle and shrink somewhat when dried and mounted in Canada

balsam. The use of acetic acid in the manner described above is much more satisfactory than that of alcohol for removing the superfluous stain and differentiating the nuclei and bacteria, and if the specimen is somewhat overstained to start with there is no danger of leaving it too long in the dilute acetic acid.

The Canada balsam is best employed in the form of a solution in xylol. The only other solvent that can be used is turpentine, as chloroform and benzol extract the aniline colors. Undissolved balsam cannot be used, for the heat required to dissolve it is apt to remove the stain from the bacteria.

Gentian-violet may also be employed in the same manner, or in a one per cent. watery solution, but the color is hardly, I think, so pleasant as that of methyl-violet, and for cover-glass preparations it does not possess any advantage. One of the quickest stains is a watery solution of fuchsin. This should be almost saturated and well filtered. If it is quite saturated precipitation is apt to occur on the specimen as evaporation takes place. The cover-glass is laid down with the spread side uppermost and a drop of the stain is placed on it. After about a minute the stain can be washed off with distilled water or weak acetic acid and the specimen examined.

Methylene-blue is almost more universally useful than methyl-violet, but the stain is not so intense. It may be used in the form of a strong watery solution, or it may be made in the same way as methyl-violet by the addition of a saturated alcoholic solution to water, but in larger proportions than in the case of methyl-violet. The watery solution stains a light blue or almost a green, but a beautiful deep blue is obtained if a little methylic alcohol be added to the solution, or if the saturated alcoholic solution be made with methylated spirit instead of with absolute alcohol. After staining in methylene-blue acetic acid should not be employed; simple washing with distilled water is sufficient.

The staining power of these solutions may be increased in two ways: either by warming the solution, or by the addition of various bodies, chiefly alkalies, and the alkaline solutions also act more quickly and powerfully when warmed. These facts were first made out in connection with Koch's discovery of the tubercle bacillus, and have since been extended to other bacteria.

Koch's first method of staining the tubercle bacillus was by the use of an alkaline solution of methylene-blue. He first made a watery solution of caustic potash of the strength of 1 to 10,000. To every 200 c. cm of this solution he added 1 c. cm of a saturated alcoholic solution of methylene-blue. The cover-glasses, which are prepared from tenacious pieces of yellow sputum or from crushed tubercles, are floated on this solution for twenty-four hours or longer, and are then placed in a saturated watery solution of vesuvin or Bismarck-brown for twenty to thirty

minutes. They are then washed in water and examined at once or dried and mounted in Canada balsam. As the result of this treatment all bacteria, nuclei, etc., become in the first instance intensely blue, but the effect of the vesuvin is to substitute itself for the blue in the cell nuclei and in all the bacteria except the tubercle bacilli. The effect is that we have blue-stained tubercle bacilli on a brown ground. This method is, however, somewhat difficult to carry out, and it is somewhat difficult to see the tubercle bacilli, hence the plan was very soon improved.

The first improvement and that which still holds the field, was the use by Ehrlich of aniline oil instead of alkalies. Ehrlich's original plan was to make a watery solution of aniline oil by shaking up the oil with water (about three per cent. of the aniline is taken up) and filtering the turbid mixture through a moist filter. To this was added a saturated alcoholic solution of fuchsin, methyl-violet, or gentian-violet, till precipitation began to occur. Weigert has worked out the best proportions in which these two should be mixed, and gives the following formula:

Saturated watery solution of aniline		100 c. cm.
Saturated alcoholic solution of fuchsin, methyl-violet, etc.	11	"

The cover-glass is floated on this solution for about twenty-four hours at the ordinary room temperature, but three or four hours are quite sufficient at the body temperature, and if the staining fluid is heated almost to boiling a few minutes are enough. The most satisfactory result is obtained when the material is kept at the body temperature for two or three hours. When the cover-glass is removed from the staining fluid the whole layer is intensely stained and the individual structures unrecognizable. It is now immersed in dilute nitric acid (1 part of strong nitric acid to 3 or 4 parts of water) for a few seconds till the layer becomes bleached. The result of this is that while the stain remains fixed in the tubercle bacilli it is, so to speak, loosened in the other elements and easily removed by means of alcohol, or displaced by a contrast stain. If the cover-glass is washed in water after being taken out of the nitric acid the color returns (red or violet, according to the stain used) and is then less easily displaced. Hence some advise that the cover-glass should be placed at once in alcohol not quite absolute, after being removed from the nitric acid, but my own impression is, that it is better to wash away the acid first in water, as acid alcohol is apt to remove the stain from the bacilli unless they are very well stained. In any case, when the cover-glass is placed in alcohol it is left till no more stain comes out, and is then stained with a contrast stain, either a watery solution of methylene-blue made up as before described, if the primary stain was fuchsin, or a saturated watery solution of vesuvin if the primary stain was violet. When sufficiently stained they are washed in water and examined, or dried and mounted in balsam. The result is that the tubercle bacilli

are red or violet as the case may be, and the nuclei of the cells and the other bacteria are blue or brown. Treated in this way, the only other bacteria, so far as is yet known, which retain the primary stain are the bacilli of leprosy. The spores of some large bacilli retain the primary stain, and elastic tissue and cheesy matter, especially the former, also retain it to some extent.

Stains made up according to the above formula become bad in a few days and must therefore be frequently renewed. This difficulty has been got over by avoiding the use of alcohol altogether, and the fluid now used in Koch's laboratory for Gram's method, tubercle bacilli, etc., is made up as follows: A saturated watery solution of aniline oil is made and filtered as above. This solution is then employed for preparing a saturated watery solution of fuchsin, methyl-violet, or gentian-violet, a large quantity of crystals of these substances being put into a bottle containing the aniline water. The fluid is filtered before use, and when exhausted fresh aniline water is added as long as any crystals remain at the bottom. This staining fluid remains good for a long time.

The mode of action of the aniline is not very clear. Ehrlich used it on the supposition that the difference in staining reactions between ordinary bacteria and tubercle bacilli depended on the tubercle bacilli possessing a sheath which can only be penetrated by coloring matters in the presence of alkalies, and which becomes impenetrable after the use of acids. But there are various facts which render it doubtful whether alkalinity is the essence of the matter. My own idea is that the aniline acts merely as a sort of fixing agent. I found¹ in my investigations on tuberculosis that the tubercle bacilli could be stained by the ordinary dyes without any aniline, but that only a few of them, probably at a certain stage of growth, could retain the stain in the presence of strong nitric acid. This is what the aniline enables them in some way or other to do. Other investigators, especially Baumgarten, have also found that these bacilli stain without the aniline. And even in the case of other bacteria the addition of aniline to the stain is an improvement, and indeed almost an essential in some instances.

Other substances have been employed to replace aniline, and with a considerable degree of success. The chief of these is a five per cent. solution of carbolic acid, first suggested by Dr. Franz Ziehl. Neelsen has modified Ziehl's solution and suggests the following:

Fuchsin	.	.	.	.	.	.	.	.	.	.	1 gramme.
Absolute alcohol	.	.	.	.	.	.	.	.	.	.	10 c. cm.
5 per cent, watery solution of carbolic acid	.	.	.	.	.	.	.	.	.	.	100 c. cm.

This is used in the same manner as the Weigert-Ehrlich solution, or the stained cover-glasses may be washed in a watery solution of sulphuric

¹ Practitioner, April, 1883.

acid (25 per cent.), instead of in nitric acid. The carbolic stain gives very brilliant results. Ziehl also succeeded with resorcin and pyrogallie acid, but the results are not so good. I have tested other substances, the best of these being phloroglucine, which acts almost as well as aniline. Toluidine is also good. Weigert recommends the following solution:

Liq. ammon. fort.		5 c. cm.
Absolute alcohol .		10 c. cm.
Distilled water .		90 c. cm.
Gentian-violet .		2 grammes.

This is used in the same manner as the others.

Gram's method of staining bacteria gives beautiful results in some instances, but it is not often necessary to use it in cover-glass preparations. Hence we may leave its detailed description till we come to sections, and the same may be done with regard to the other special methods, such as those for syphilis, double staining, etc.

Staining with vesuvin or Bismarck-brown was at one time much used in order to obtain specimens for photography, but since the introduction of the new plates by which blue and red stained specimens may also be photographed, this has fallen into disuse. One way of using the brown is to stain in a saturated watery solution of vesuvin, wash in water and examine, or dry and mount in Canada balsam. The method recommended by Koch was, however, to make a concentrated solution of vesuvin or Bismarck-brown in equal parts of glycerine and water, filtering before use. The specimens were afterward mounted in glycerine.

Quite recently it has been found that spores which, when completely formed, remain unstained when treated with the ordinary aniline dyes, can be stained by a special method. Koch and Gaffky noticed, when staining material containing tubercle bacilli with aniline methyl-violet, that not only the tubercle bacilli, but also the spores of a large bacillus retained the blue, while the other bacteria, and indeed the bacilli containing these blue stained spores, took on the brown stain. Hence there was here a differential staining of spore and adult bacillus. By using the same method, however, the spores of other bacteria could not be stained, but Neisser succeeded in getting double staining in other cases by using warm aniline fuchsin, and subsequent staining with methylene-blue; the spores remained red, the rest of the rod became blue. Buchner and Hueppe have worked out the matter, and Hueppe has obtained both isolated staining of spores and double staining of spore and rod. The isolated staining of the spore is managed in this way: it the cover-glass is passed through the flame oftener than three times, the staining property of the bacteria and protoplasm is diminished, and after passage through the flame six or ten times they do not stain at all. On

the other hand, after the preparation has been passed through the flame from seven to ten times the spores acquire the property of staining with watery solutions of the basic aniline dyes, so that an isolated staining of the spores is the result. Hueppe also obtains double staining in the following manner: The cover-glass is passed through the flame three times, and then stained for ten to twenty minutes in a warm solution of aniline fuchsin (as used for tubercle). After removal from this solution it is washed in water, and then either stained with methylene-blue or placed for a few seconds in absolute alcohol, and then in the contrast stain. The spores come out red, the bacilli blue.

The flagella with which some bacteria are provided are said not to take on the aniline dyes, though I doubt if this statement is correct in all cases. On the other hand, they can be stained in a concentrated watery solution of hæmatoxylin.

Much more difficult than these cover-glass preparations is the manipulation of sections of the tissues. In this connection we have to consider the methods of hardening, of cutting, and of staining.

2. *Sections of the fresh tissues* may be made by means of freezing microtomes without any preliminary hardening, but the sections are not easily manipulated and in many cases the staining is most unsatisfactory. Hence it is best, whenever possible, to harden the tissues. If the fresh tissue is cut, the sections should be received in salt solution (one-half per cent.), and then placed by means of a spatula in absolute alcohol for a few minutes. From this they come into the staining fluid, and the best, for this purpose, is a saturated watery solution of vesuvin.

Of the hardening reagents the most useful is absolute alcohol, but Müller's fluid or a strong watery solution of bichloride of mercury may be employed. The tissues must be cut up into small pieces and placed in a large quantity of absolute alcohol, which should be frequently changed. Treated in this way the tissue is sufficiently hardened, and, indeed, in its best condition for staining in about three days. After several weeks' immersion in alcohol some bacteria do not stain so well as at first, and hence to keep the tissues permanently one should not use absolute alcohol, but a weaker alcohol: methylated spirit does very well for this purpose. In Müller's fluid (potassium bichromate, 2 grammes; sodium sulphate, 1 gramme; distilled water, 100 c. cm.) the tissues must be kept for from two to three weeks and are then ready for cutting, or after removal from Müller's fluid they may be placed in dilute alcohol and then transferred to and preserved in strong alcohol.

The tissues hardened in alcohol are best cut with a microtome, either a freezing microtome, or one for cutting under alcohol. If a freezing microtome is used, the alcohol must be first removed from the tissue by placing it in a large quantity of water. At first the tissue floats but after a short time it sinks, and in an hour or two it may be placed in a

thick solution of gum. It remains in this for some hours to allow the gum to soak thoroughly into it. It is then frozen with either an ice or ether freezing machine. The best freezing microtome is, in my opinion, Williams's, and this can be easily arranged to act with ether. If ice is used, a few drops (six or eight drops per ounce) of methylated spirit should be added to the gum to prevent it freezing too hard, but with the ether machine this is not necessary as it is quite easy to regulate the degree of hardness of the gum. When cut the sections are placed in tepid water to dissolve out the gum, and are then removed to alcohol before being placed in the stain. In the case of Müller's fluid, the tissues may be placed at once in gum and then treated in the same way as the other.

At one time I used to prepare all the sections in this way, by first hardening the material in alcohol and then freezing, because very fine sections were thus obtained, but though this plan answers very well in the case of some bacteria, such as tubercle bacilli, I have come to the conclusion that on the whole a better result is obtained if the tissues are not placed in water after hardening, but are cut under alcohol. And after all, though the sections are a little thicker, this is no disadvantage, for one is less likely to miss the bacteria if they are few in number than when a very thin section is employed. For this purpose Thoma-Jung's microtome is the best. The bits of tissue are fixed on pieces of cork which can be grasped by the clamp of the microtome. The specimens are easily fixed on the cork by means of a mixture of gelatine and glycerine prepared in the following manner: Dissolve 5 grammes of gelatine in 10 c. cm. of distilled water, and then add 20 c. cm of glycerine. A minute portion of this is melted by heat and placed on a smooth piece of cork of suitable size and shape; on this the piece of tissue, from which the superfluous alcohol has been sucked off by means of blotting paper, is placed and the cork is then put into absolute alcohol. The glycerine jelly becomes quite firm after being left for a few hours in alcohol. Where the tissues are friable they must be embedded in paraffin or celloidin, best in celloidin. The tissue after having been hardened in alcohol is placed for some hours in a mixture of alcohol and ether. It is then removed to a solution of celloidin in equal parts of alcohol and ether and left for some hours. It may then be fixed on a cork by means of celloidin or laid in a paper mould filled with celloidin. In either case the specimen with its coating of celloidin is placed in an eighty-two per cent. alcohol to harden and is then cut as before. After the sections are cut they are put into alcohol.

The methods of staining differ for different bacteria, but are very similar to those described under cover-glass preparations. Where sections are being examined for unknown bacteria, the best solution to

employ is probably Löffler's alkaline methylene-blue. The formula is :

100 c. cm. of a 1 to 10,000 solution of caustic potash.

30 c. cm. of a saturated alcoholic solution of methylene-blue.

The sections are left in this solution for from half an hour to an hour, and are then washed in distilled water or in dilute acetic acid (one-half per cent.). If they are washed in acetic acid they must again be put in water to remove all the acid. They are then placed in alcohol to remove the water, then in oil of cedar, in which they may be examined or from which they may be mounted in Canada balsam dissolved in xylol. Oil of cloves should be avoided in all cases, as it is apt to dissolve out the stain from the bacteria.

The original method introduced by Weigert and Koch was to stain in a saturated watery solution of fuchsin, gentian-violet, or methyl-violet, or in a solution made as before described by adding a saturated alcoholic solution to water. From this the sections were transferred to water and then, in order to have only nuclei and bacteria stained, to dilute acetic acid; afterward to water again, alcohol, oil of cedar, etc. The acetic acid is, however, very apt to remove the stain from the bacteria, and hence it has been found best to give up acetic acid and use alcohol for differentiating the nuclei and bacteria. Thus, after being washed in water, they are at once placed in alcohol.

It is better when employing these stains to use the solutions in aniline water, because a deeper stain is thus obtained, and also because more bacteria take on the stain than when the plain watery solutions are used. The best stain is the saturated solution of gentian-violet, fuchsin, etc., in aniline water. This stains in fifteen to thirty minutes and the sections may or may not be washed in dilute acetic acid.

In sections stained in this way a double stain may often be obtained. Sections stained in aniline gentian-violet and washed in alcohol may be placed for a short time in a dilute alcoholic solution of eosin, and then again washed in alcohol and placed in oil of cedar. The result is that the bacteria and nuclei are blue and the remainder of the section rose-colored. In the same way violet stained specimens may be placed in various carmine solutions (chiefly picrocarmine), when the nuclei come out red and the bacteria violet, or specimens colored red may be stained in hæmatoxylin. In these cases, however, it is best to employ Koch's method of obtaining isolated staining of the bacteria before staining in the contrast stain. This is done by placing the sections, after being stained, in a solution made of equal parts of a saturated solution of potassium carbonate and distilled water. They remain there five minutes and are then transferred to alcohol.

One of the most beautiful methods of staining is Gram's method, but, unfortunately, only a few bacteria stain in this way. The sections are

stained either in the Weigert-Ehrlich tubercle solution or in the saturated aniline solution of gentian-violet. Twenty to thirty minutes suffice. They are then at once placed in a solution of iodine (1 part of iodine, 2 parts of potassium iodide, and 200 parts of water) for five or fifteen minutes. Thence they are transferred directly to alcohol and left there till no more stain comes out. (It is frequently necessary to change the alcohol several times.) The result is that the section has a faint yellowish tinge while the bacteria appear of a blackish-blue color. These sections can then be double-stained by immersing them for a short time in a dilute solution of vesuvin, or, better, by placing them in a solution of picro-lithium carmine (1 part of lithium carmine and 3 parts of picric acid). In fact, the best way is to stain the sections first in picro-lithium carmine, then wash them in alcohol, and then stain with Gram's method; the nuclei and tissues retain the picrocarmine while the bacteria take on the gentian-violet. In this case care must be taken that the picrocarmine is fresh, for bacteria are very apt to grow in it, and, if that has occurred, when the specimen is afterward put in Gram's solution the bacteria adhering to it are stained, and mistakes are thus apt to occur. In staining with Gram's method the sections must not be put in water at all, and, indeed, it is important to remember in all these methods that it is best to put the sections straight from the alcohol in which they were first placed, after being cut, into the staining fluid and not to wash first in water.

Tubercle bacilli are stained in the same manner as described before under cover-glass preparations. The aniline fuchsin is the best solution to use, as the preparations are more permanent than those stained by gentian-violet. Various attempts have been made to get rid of the nitric acid, as it is apt to spoil the sections if they are very thin. In my paper on tubercle I suggested the following method: After staining the sections in Weigert-Ehrlich's fuchsin solution, wash in alcohol, and then place in the following:

Distilled water		100 c. cm.
Saturated alcoholic solution of methylene-blue	:	20 "
Formic acid		10 minims.

The sections are left for one or two hours in this solution and then washed in water, alcohol, etc. This method is not so certain as the older plan and, therefore, I only suggest its use for very delicate sections which are apt to be spoilt by the nitric acid.

Orth uses acidulated alcohol instead of nitric acid (one part of hydrochloric acid to 100 parts of 70 per cent. alcohol). Neelson employs dilute sulphuric acid as mentioned before. Other workers also employ acidulated alcohol. In fact, the acid is not absolutely necessary, for the contrast stain will ultimately replace the first stain in everything

but the tubercle bacilli if it only acts long enough; indeed this was what occurred in Koch's original plan with methylene-blue and vesuvin. Gibbes has suggested a double stain in which the bacilli become red and the tissues blue, but, unfortunately, this does not give thoroughly reliable results.

Leprosy bacilli stand midway between ordinary bacteria and tubercle bacilli in that they can be stained by the ordinary stains, more especially by methylene-blue, while they also have the same reactions as tubercle bacilli in resisting the nitric acid after staining with Weigert-Ehrlich's solution. In fact, this is the best way to stain them.

Lustgarten has described bacilli in sections of gummata and other syphilitic products which stain in a characteristic manner. His method is the following: the sections are stained in the Weigert-Ehrlich gentian-violet solution in the same manner as for tubercle bacilli. They are then placed for a few minutes in alcohol and then for ten seconds in a one and one-half per cent. watery solution of potassium permanganate. From this they are transferred to a watery solution of pure sulphurous acid. The specimen becomes bleached in a few seconds. If it is not sufficiently bleached it is washed with water and put back in fresh permanganate solution for two or three seconds and then again into sulphurous acid. This is repeated till the specimen is completely bleached; it is then washed with water, alcohol, etc. The bacilli come out violet, the rest of the tissue is colorless. They differ from tubercle and leprosy bacilli, which are also stained by this method, in that the syphilis bacilli are decolorized by the nitric acid method. De Giacomi suggests the use, first, of a dilute, and then of a concentrated solution of ferric chloride instead of the potassium permanganate and the sulphurous acid. In the healthy smegma, Alvarez and Favel have also found bacilli which show the same reactions and are of similar appearance, and their statements have been confirmed by others.

Several other bacteria are difficult to stain, but the peculiarities of each kind will be referred to later. Typhoid bacilli are best stained with the alkaline methylene-blue, and so are the bacilli of glanders, which are very difficult to stain. The spirilla of relapsing fever stain in cover-glass preparations of blood with methyl-violet, fuchsin, etc., but in sections the best solution is a watery solution of vesuvin or Löffler's methylene-blue solution.

For fungi in the tissues the methylene-blue solution is the best. For actinomyces Weigert recommends a solution of orseille dissolved in a mixture of 20 c. cm. of absolute alcohol, 5 c. cm. of acetic acid, and 40 c. cm. of distilled water, till the fluid is dark red. The sections are stained in this for an hour, then washed in a one per cent. watery solution of gentian-violet, and afterward in alcohol, oil of cedar, etc.

The rays of the fungus are stained bright red and the nuclei of the tissue violet.

In examining stained specimens with the microscope the focussing of the light, the centring of the condenser, and the correction of the lens must be carried out as carefully as in the other case, but instead of a small diaphragm a large one or no diaphragm at all must be employed. The reason is this: in the unstained specimen one wants to see as much of the structure picture as possible and, therefore, light must be shut off; but in stained specimens the stained objects would only be obscured by the structure picture, whereas they are quite as easily recognizable in a flood of light, while the structure picture disappears. The only objections to the entire absence of a diaphragm are, first, that if the light is very intense it is painful to the eye, and secondly, that it is only a very good lens that can stand the complete absence of the diaphragm, for if the lens is imperfect the image appears blurred.

Before examining specimens mounted in balsam with an oil lens it is well to surround the margin of the cover-glass with some material impermeable to oil, such as shellac, and allow this to harden before use. Hence, the investigation of the specimen, in the first instance, is made with the specimens in oil of cedar, and only when it is desired to preserve the specimen is it mounted in Canada balsam.

INTESTINAL CONCRETIONS RESEMBLING SAND, AND ORIGINATING IN CELLS FROM THE BANANA.

BY N. L. BATES, M.D.,
MEDICAL INSPECTOR U. S. N.

OBSCURE and puzzling cases may eventually prove to be unexpectedly plain. What has been done by one is liable to be repeated by others; hence the history of my cases and of the efforts made to ascertain the nature of the unknown substance which caused them may save time and trouble to some one who might otherwise become involved in a search similar to my own.

Four years ago I washed from the fecal movement of a child a half ounce or more of siliceous, organic cells, closely resembling in external appearances fine black sand. Since that time these cells have been examined by many of the ablest chemists, microscopists, and physicians of the country, who were unable to give any information as to their origin, or even to decide whether they belonged to animal or vegetable life. Twice I read articles on the subject before societies; in one instance before a large audience representing almost every branch of scientific

research. Specimens were shown, both in the natural state and with the microscope, but no one present identified them with any known cells. The specimens had been seen and examined by more than a hundred physicians and microscopists, when Dr. Robert T. Edes recognized them as probably of similar origin to those he had described in the *Boston Medical and Surgical Journal* of May 10, 1883, and which had been identified as coming from the banana. My cases are as follows:

CASE I.—Yokohama, Japan, July, 1882. Eva M., aged five years. Only child of American parents, both living; a pale, delicate-looking girl, sedate and precocious, with a history of indigestion, habitual constipation, and occasional attacks of gastric catarrh. The constipation and indigestion commenced when the child was two years of age, and were without apparent cause, but led to such care and watchfulness on the part of the mother and other members of the family that every minute detail of the child's life could be given.

On my first visit, the patient had fever, vomiting, gastric pain and tenderness, a tense, hard abdomen, and constipation. The bowels were relieved with great difficulty. Frequently repeated and large enemata were thrown well up the bowel, but the atony of the intestine was so great that the water was retained and oozed away on a folded sheet placed under the hips. I noticed one morning that this sheet was liberally sprinkled with a fine black sand; the mother said that these gritty particles came from the bowels, caused the child much uneasiness, and that she had folded the sheet differently several times on account of them. They were clean, and there was no appearance of fecal matter or discoloration on the sheet. I saved some of the deposit, and directed the mother to send me the first fecal movement, and as much of the sand as she could gather. Shortly after, the obstruction yielded to an enema containing one-half ounce fluid ext. of senna, and an enormous and very offensive fecal movement was obtained. The mother sent me only a small portion of it, from which I washed a tablespoonful or more of a substance closely resembling in general appearance fine black blotting sand. I am unable to state how much there was in all, but the mother of the child estimated the amount as two teacupfuls of sand in a chamberful of feces.

The relief was immediate, and practically the end of the case. A month later there was a lighter attack of similar character, but no obstruction in the intestine and only a small quantity of the black deposit. The child passed from under my care a few months later, returned to the United States, and died of diphtheria about two years afterward. Up to the time of her death there were no severe gastric or abdominal attacks, and although carefully looked for, no more black specks were ever seen. Had there been any, I am sure they would not have escaped recognition.

CASE II. occurred in Washington, November, 1885. This was the youngest of several children of parents both living, a girl, six years of age, with a pallid, muddy complexion, and a history of malaria, constipation, pasty clay-colored stools, and worms (?). There was a distended but tympanitic abdomen, pain in the left side just below the ribs, but no acute symptoms. The urine was normal, and no enlargement of liver or spleen was detected. It was only because I was attending another

child in the same family that my attention was called to this case. The mother stated that at frequent intervals, for two years, she had given the child santonin and castor oil for worms, and always with good effect. No worms had ever been seen, only "eggs and skins." I prescribed the same remedies, and requested that all the movements should be saved. The result was the same as on previous occasions, but the so-called worm skins were long strings and shreds of tough mucus, and the eggs, although in small quantity, at once recalled my Yokohama experience.

I have heard of three, perhaps four, similar cases; one in Japan, one in Washington, one in Ohio, and the fourth in Massachusetts. Of the first, Dr. Stuart Eldridge, of Yokohama, writes:

CASE III.—"The child was, in this case, though stout and fairly strong for its age, three years, and previously, according to the mother's account, perfectly healthy, of a pasty complexion, and for some days before I saw it troubled with colic-like pains, which were relieved by a stool, to recur spontaneously within twelve to twenty-four hours. I was sent for because the mother detected the abnormal particles in the stool; these were so plentiful in the specimen I examined as to form nearly one-fourth of the whole mass, the amount sent me being that of a good copious evacuation." "The grains were exactly like those" in the Eva M., Yokohama case. This case was not seen again, and no further history obtained.

CASE IV. is reported to me by Dr. C. H. H. Hall, U. S. Navy. His own child, a boy, three years of age, passed a half teaspoonful of black, sandy-looking grains after a dose of santonin and castor oil had been given—none had ever been seen before, and although looked for, none have been seen since. No examination was made, but in general appearance they resembled my specimens.

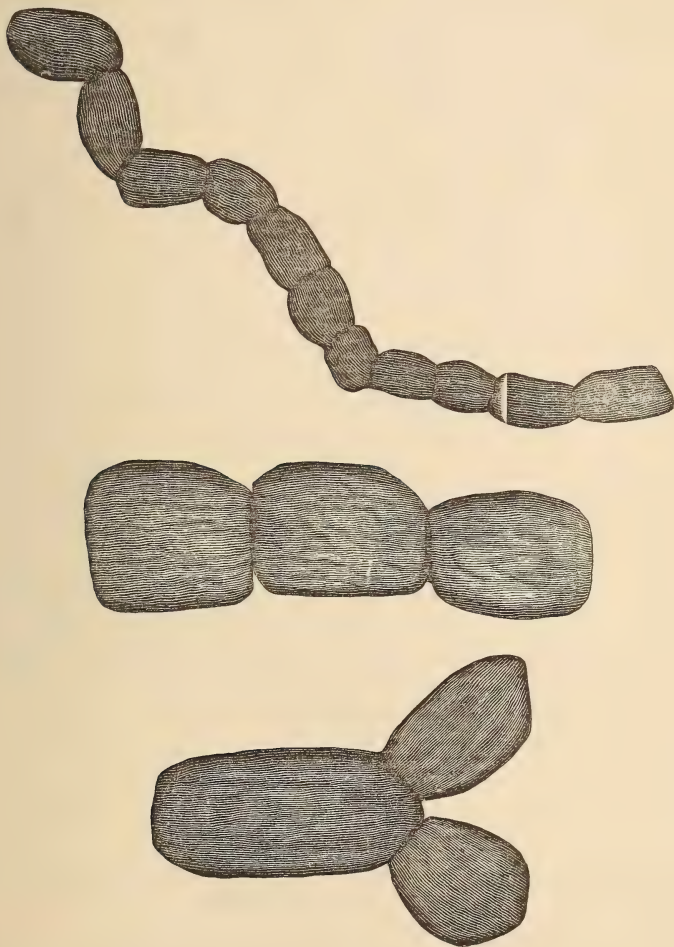
CASE V.—The clinical history is wanting. Prof. Romyn Hitchcock received some years ago, from a physician in Ohio, specimens which he is quite sure were the same as mine, but he does not now know who sent them nor the history of the case.

I have been promised the details of a case occurring in the practice of a physician in Salem, Mass., but have not received them.

In my cases the cells were of such peculiar character that identification would have seemed comparatively easy; yet it was in their most striking characteristics that they differ from the banana cells in their natural state, where they are white, translucent, and only resemble in size and form the objects from the intestine. If a transverse slice of banana is placed in a watch-glass and covered with strong nitric or sulphuric acid, a double row of cells, with a spiral fibre between, will become visible, enclosing three lobes in the centre of the slice, and the cells will eventually become of a garnet-red color. They are not so deep in color as my specimens, and have not the weight and resistance, but otherwise resemble them closely.

The cells from my Yokohama case could not be readily cut or crushed; were deep red-brown in color; had a sp. gr. 1.59; and contained four per cent. of silica. With the naked eye and sense of touch they could not have been distinguished from so much blotting sand. As passed from the bowel on the sheet they were perfectly clean, free from fecal or

other adherent matter, with nothing to give any clew to their origin, except size, form, and the manner in which they were joined together, and in none of them was there anything which could indicate a probable source. Their appearance under the microscope is well shown in the accompanying illustrations.



One of my patients, so the mother said, had never eaten fruit of any kind. In answer to a direct question, however, she admitted that the child had occasionally eaten a small piece of banana. The Yokohama child had eaten banana quite freely some months before I saw her; but, as the fact was not mentioned, and the fruit not at all common in Yokohama, I had no reason to suspect it. I examined the drinking water and all suspected foods, including native fruits and candies.

The Japanese persimmon was suggested as a probable source by a Japanese microscopist, but I did not find any cells in them like mine. I have recently thought, however, that treatment by nitric acid might develop them, and have requested a friend in Japan to make a thorough examination of the persimmon.

The banana may not be alone responsible for this black sand in the intestine, but with the recognition of one source, others may be more readily ascertained. The number of cases collected, and the clinical history of some of them, are enough to give these objects sufficient importance to be remembered.

A suspicion of entozoa was or might naturally have been entertained in most of the cases. So far as known, all the cases were children, and constipation was a prominent symptom. Some, but certainly not all, may have been constipated from birth, and had the elongated descending colon which Prof. Jacobi has noticed as a cause of constipation in infants.

Severi, Alberto (*Lo Sperimentale*, Firenze, 1884, xiii. 482-508) gives statistics of measurements of the large intestine in the fœtus and in children. From the seventh month of fetal life to the end of the second year of child life, the length of the large intestine exceeds the length of the child. With increased age and growth the excess is lost, and finally disappears. It may be that the more numerous folds and flexures of the large intestine of the child favor the accumulation of these objects, and that the intestine in later life is not adapted to their retention.

At all events, I am disposed to regard a prolonged stay in the intestines as necessary for the development of the deep color; hard, sharp, and gritty character; high specific gravity, and siliceous contents of these cells; and when thus developed, they are no more innocent than would be a corresponding quantity of sharp sand.

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THE ACTION OF SULPHURIC ETHER ON THE PERIPHERAL NERVOUS SYSTEM.

FROM EXPERIMENTS PERFORMED IN THE PHYSIOLOGICAL LABORATORY
OF THE HARVARD MEDICAL SCHOOL, BY DR. F. H. HOOOPER,
DR. F. W. ELLIS, AND MR. J. W. PERKINS.

BY H. P. BOWDITCH, M.D.,
PROFESSOR OF PHYSIOLOGY IN HARVARD UNIVERSITY.

IN an article on "The Respiratory Function of the Human Larynx" in the *N. Y. Medical Journal* for July 4, 1885, Dr. F. H. Hooper recorded the observation that stimulation of the recurrent laryngeal nerves of

dogs causes a dilatation of the glottis when the animals are thoroughly etherized, but a constriction when they are slightly or not at all under the influence of the drug. As the phenomenon occurred equally well whether the stimulation was applied to the intact nerve or to its peripheral end after section it was evident that the action of the drug must be either upon the peripheral portions of the nerve or upon the muscles.

In order to decide between these alternatives, and to ascertain whether similar observations could be made upon other groups of antagonistic muscles supplied by a single nerve trunk, experiments were undertaken by Mr. J. W. Perkins, interne at the Children's Hospital, Boston, in the autumn of 1885.

The sciatic nerve of the frog, with the groups of flexor and extensor muscles which it supplies, was selected for purposes of experiment. The frog was prepared by destroying the medulla and cord. The sciatic plexus was dissected out on both sides and shielded electrodes placed on the nerves close to their origin from the cord. The frog was then suspended in such a way that the hind legs hung freely in fluid contained in two beaker glasses, one leg being immersed in a 0.5 per cent. solution of common salt and the other in a similar solution to which three per cent. of sulphuric ether had been added.

Tetanic stimulation of the sciatic plexus was produced by a Du Bois Reymond induction apparatus having a secondary coil consisting of 10,260 turns of fine wire and graduated with arbitrary units of intensity such that the maximum stimulation, produced by pushing the secondary completely over the primary coil, corresponded to 1000 units of intensity.

The experiment consisted in applying, at short intervals, a tetanic stimulation of very weak intensity ($I = 0.5 - 2$) to each sciatic plexus in turn and observing the position of the legs as one of them gradually came under the influence of the ether. It was observed that at the beginning of the experiment stimulation produced the same effect on both sides; viz., extension of the leg and abduction of the toes. After the ether had been applied five or ten minutes this effect gave place to a flexion of the leg and adduction of the toes, and after about twenty minutes the stimulation failed to produce any effect. Stimulation of the nerve on the side where the leg was immersed in the salt solution produced the same extension as in the beginning of the experiment. The solutions were now interchanged so that the etherized leg was suspended in the salt solution, and *vice versa*. As the effect of the ether disappeared from the leg in the salt solution the stimulation of the nerve produced at first flexion and adduction which afterward gave place to extension and abduction as at first. This experiment was repeated with very constant results upon five different frogs.

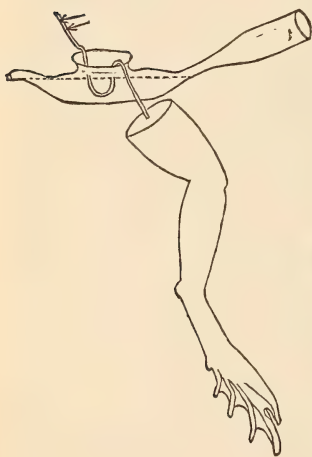
It thus appears that there is a stage in ether narcosis when stimulation of the nerve, which ordinarily produces extension and abduction,

causes the opposite effects and this action can be observed both when the narcosis is coming on and when it is passing off. For the sake of brevity, this action of ether will be termed the "ether effect." The phenomenon is apparently the same as that observed by Hooper on the larynx and, so far as the physiological action of ether is concerned, the constrictors of the larynx seem to correspond to the extensors, and the dilators of the larynx to the flexors of the leg, an analogy the reverse of that which was maintained by Rosenbach,¹ who was led to his conclusions by pathological considerations.

Since in these experiments the central nervous system was destroyed, it is obvious that this "ether effect" must be at the periphery, but whether upon the nerve trunks, the nerve terminations, or the muscular fibres cannot be decided from the above experiments.

To study this question the following experiment was performed. The sciatic nerve was freed from its connections for a distance sufficient to permit the portion of the nerve between the electrodes and the muscles to be immersed in a solution of ether. This was most readily effected

FIG. 1.



by means of a bent glass tube, with a hole blown in the side, such as is represented in Fig. 1. The tube was bent or inclined at such an angle that fluid introduced by means of a pipette into the upper end would flow down and cover a loop of the nerve and could at the same time be readily washed away and replaced by another fluid introduced in the same way. Five experiments performed in this way gave results which were very constant and quite similar to those obtained when the ether was applied to the skin of the leg. The only important difference was that the action of the ether was much more prompt when applied directly to the nerve, complete paralysis taking place in about seven minutes. The "ether effect" manifested itself both in

flexion and adduction and occasionally in peculiar twisting movements of the phalanges due to unequal stimulation of the various muscles. The important observation was also made that whenever flexion was obtained it could be converted into extension by *increasing the intensity* of the stimulation.

From these experiments we are justified in concluding that the "ether effect" is a phenomenon dependent upon the action of the drug upon

¹ Bresl. ärztl. Zeitschr., 1880, Nos. 2 and 3.

the nerve fibres themselves, though, of course, the possibility of a simultaneous action upon the muscles is not excluded. An attempt was made to ascertain whether any such action of the drug upon the muscles really occurs by poisoning a frog with curare and applying electricity directly to the limb while immersed in a solution of ether.

It was found, however, to be practically impossible to apply the electricity in such a way as to stimulate uniformly all the muscles of the limb and thus produce a movement comparable with that obtained when the muscles are stimulated through the nerve. The experiments made in this way were, therefore, inconclusive. It is evident, however, that the observed action of ether on the nerve trunks is sufficient to explain the "ether effect," and since, when one sufficient cause is demonstrated, it is illogical to assume the existence of another, we may conclude for the present that the phenomenon in question concerns exclusively the nerve fibres.

We must next inquire whether the ether can be supposed to exercise an elective action upon the fibres contained in the nerve trunk and to paralyze the fibres supplying the extensor and abductor muscles before it affects those which go to the flexor and adductor group, or whether some simpler and more probable explanation can be suggested.

The above-mentioned observation that flexion could be converted into extension by increasing the intensity of the stimulation, suggests the idea that the "ether effect" may be simply *partial paralysis* of the nerve fibres. On this hypothesis we should expect to find that stimulation of the nerve with a *very weak* current would cause flexion of the limb, even without the application of ether.

To test this question and also to study the effect of various other reagents besides ether upon the nerve trunk, a series of experiments on frogs were undertaken in the spring of 1886, by Dr. F. W. Ellis.

In these experiments the frog was prepared in the same way as by Perkins, but the position of the legs resulting from the stimulation of the nerve was recorded by means of photography. For this purpose the legs of the animal were suspended in water contained in a large cell with parallel plate glass sides. Behind the cell a piece of opaque white glass afforded a suitable background and in front was placed a dry plate camera by means of which the position of the legs could be photographed instantaneously. The drugs used were mixed with one-half per cent. solution of sodium chloride in distilled water and applied to the nerve in the manner above described.

The ordinary effect of an electrical stimulation of the sciatic nerve is well shown in Fig. 2.¹ Even with quite weak currents there is ordinarily

¹ This and the following figures are photoelectrotype reproductions of photographs taken in the manner above described. As the frogs were suspended with their ventral surface toward the camera the right leg of the animal appears on the left of the figure, and *vice versa*.

marked extension of the knee, ankle, and toes, accompanied by strong abduction of the toes. In other words, the position of the leg is that assumed when the animal is just completing a vigorous stroke in swimming.

FIG. 2.



EFFECTS OF ETHER.—In the experiments with ether, solutions of the drug varying in strength from one-half to five per cent., were employed. A three per cent. solution was most frequently used and gave, upon the whole, the best results. The observations of Perkins were in the main confirmed—*i. e.*, there was found to be a stage in the paralyzing action of the drug when stimulation of the nerve caused the leg to assume a position contrary to that occa-

sioned by the same degree of stimulation without ether. Instead of extension at the knee and ankle, there might be flexion; instead of extension and abduction of the toes, there might be flexion or adduction, or both. It was rare that all these contrary effects were manifested at once. There was generally a predominance of one, and frequently only one was manifested. These “ether effects” were obtained with some frogs more easily than with others, and were not always constant for the same frog. They were generally better obtained when the nerve was recovering from the effects of ether (*i. e.*, after removal of the ether solution from the tube and washing the nerve with saline solution) than when it was coming under the influence of the drug.

FIG. 3.



Ether on nerve.

FIG. 4.



Ether removed.

Figs. 3-8 illustrate these “ether effects.” Fig. 3 shows the position assumed by the left leg on irritation of the sciatic nerve during the local application of ether. Fig. 4, the position assumed by the same leg after the removal of the ether. Here flexion and adduction under ether gave place to extension and abduction on removal of the drug. Figs. 5 and 6

show a similar "ether effect" on the right leg, but confined in this case to the muscles moving the toes.

FIG. 5.



Ether on nerve.

FIG. 6.



Ether removed.

In Figs. 7 and 8 the "ether effect" manifests itself in a flexion of the foot and adduction of the toes combined with a strong extension of the leg.

FIG. 7.



Ether on nerve.

FIG. 8.



Ether removed.

The local application of ether to the nerve was found not to affect the irritability of the nerve below the point of application. This was shown by experiments in which electrodes were placed upon the nerve, both above and below the ether tube. When powerful stimulation applied above the tube no longer caused contraction of the muscles, a very slight current applied below would produce the usual effect. The ether, therefore, seemed to produce a change in the nerve at the point of application, which rendered it incapable of transmitting the ordinary nerve impulse, complete paralysis resulting when the action of the drug was pushed to its extreme, and the so-called "ether effects" during intermediate stages.

Experiments with chloroform and alcohol showed that the "ether effects" could be obtained with these drugs also, although not so strik-

ingly as with ether. A full discussion of the action of these and other drugs will be given on a future occasion.

It was also found, as had been previously observed by Perkins, that an increase in the intensity of the stimulation caused the "ether effect" to disappear, and the ordinary effect of nerve irritation (*viz.*, extension and abduction) to take its place. This led to experiments on the effect of variation in the intensity of the stimulus, and particularly on the

EFFECTS OF VERY WEAK CURRENTS.—The first experiments showing the effect of very weak stimulation were accidental. It was noticed occasionally, when the right sciatic plexus was very strongly stimulated in order to ascertain whether the application of ether to the nerve of that side had produced complete paralysis, that movements of flexion were produced in the leg of the opposite side. These were obviously due to the escape of electricity upon the left plexus, and it was observed that a still further increase in the intensity of the stimulus applied to the right plexus caused the ordinary movements of extension and abduction on the left side. It was subsequently found that by employing weak currents it was generally possible to cause movements (*viz.*, flexion and adduction), which were ordinarily excited by very much stronger stimuli after the application of ether to the nerve. To produce these effects, it was necessary to use currents of very feeble intensity. These were best obtained by separating the secondary coil of the induction apparatus

FIG. 9.



Weak irritation.

FIG. 10.



Strong irritation.

forty or fifty centimetres from the primary, and then turning it round a vertical axis. When flexion and adduction had been obtained in this way it was always possible to produce the ordinary movements of extension and abduction by increasing the intensity of the stimulation. Occasionally, as a result of very weak stimulation, twitchings or clonic contractions of the muscles were produced. These seemed to be due to a conflict between opposing sets of muscles.

Figs. 9-13 illustrate the effects of variations in the intensity of the

stimulation applied to unetherized nerves. Fig. 9 shows the position assumed by the left leg under the influence of a very feeble stimulus applied to the sciatic nerve of that side, and Fig. 10 the effect of a stronger stimulus applied to the same nerve.

FIG. 11.



Weak irritation.

FIG. 12.



Strong irritation.

Figs. 11 and 12 show, in a similar manner, the effect of increasing the intensity of the stimulus applied to the right sciatic nerve. Fig. 13 shows the effect of a weak irritation of the left sciatic nerve, and by comparing the position of the left leg in this figure with that of the right leg in Fig. 2, a good idea can be obtained of the great variety of movement which can be produced by changes in the intensity of the stimulation.

FIG. 13.



Weak irritation.

These experiments by Ellis prove beyond a doubt that the effects observed by Perkins on stimulating a nerve immersed in a solution of ether, can be obtained with other drugs, and often with very weak currents without any drug. Without ether, flexion and adduction are to be obtained only with very feeble currents, but with ether much stronger stimulation produces the same effect. In both cases, however, an increase in the intensity of the stimulus causes these movements to give place to extension and abduction; the effect of the ether may, therefore, be said to consist in transferring the point, on the scale of intensity, at which the effect of nerve irritation changes from flexion and adduction to extension and abduction from the region of weak to that of relatively strong stimulation.

The "ether effect," as observed in the sciatic nerve of the frog, may be best explained by supposing that a partial paralysis of the nerve by the drug converts what would naturally be a strong into a weak irritation, and that this weak irritation affects only the flexor group of mus-

cles because these are, for some reason or other, more irritable than their antagonists. A stronger irritation or a removal of the ether causes extension, since when both flexors and extensors are stimulated, the position of the leg is determined by the latter—*i. e.*, the more powerful group.

The question of the difference in irritability of the flexors and extensors of the frog's leg and the cause thereof has been much discussed. The fact that a feeble irritation of the sciatic causes flexion, and a strong irritation extension of the leg was first observed by Ritter in 1798, but the subject was first thoroughly investigated by Rollett in 1874-75.¹ This observer experimented with the amputated leg suspended in the air, and also with the muscles attached to myographic levers, and reached the conclusion that the cause of the greater irritability of the flexors was to be sought in the nerve fibres or in their mode of attachment to the muscles. Bour,² also, while criticising some of Rollett's methods, found that when the irritation was applied to the upper portion of the sciatic nerve, the flexors were called into action by a feebler stimulus than the extensors.³

There seems, therefore, to be no doubt that the flexor apparatus of the frog's leg responds to a feebler stimulation than the extensor, but whether the cause of this difference lies in the nerve fibres, the muscle fibres, or in the mode of connection between the two, must be left for future investigations to determine. It is not impossible that the microscope may reveal histological differences between the different sorts of muscles similar to those described by Ranvier and others between the red and white muscles of the rabbit.

We must now inquire whether the above explanation of the "ether effect," as studied on the sciatic nerve of the frog, is applicable to the action of the drug, as observed by Hooper, on the recurrent laryngeal nerve of the dog.

A single observation upon a chloralized dog is reported by Hooper, in which a thread passed through the nerve and left in position for several days produced an effect analogous to that of ether on the sciatic nerve of the frog, *viz.*, abduction of the vocal cord on irritation of the nerve on the side thus operated upon, while the same irritation on the opposite side produced the ordinary effect, *viz.*, adduction. As all attempts to repeat this observation failed, no importance can be attached to it. On the other hand, it had never been observed in Hooper's ex-

¹ Sitzungsberichte der Wiener Acad. Dritte Abth., lxx. S. 7; lxxi. S. 33; lxxii. S. 349.

² Verhandl. d. Phys. med. Gesells. in Würzburg. N. F. viii. 221.

³ Dr. W. P. Lombard has kindly made a few experiments upon the irritability of the muscles moving the knee-joint of the frog, using for the purpose the delicate apparatus employed by him in studying the reflex actions of the frog (Archiv für Physiologie, 1885, p. 408). These experiments, though interesting in themselves, are not conclusive as to the relative irritability of the flexor and extensor groups of muscles. The evidence, however, seems to be slightly in favor of the above mentioned conclusion of Bour.

periments that feeble irritations caused a dilatation of the glottis, while stronger ones caused a constriction, but, as the effect of *very feeble* stimuli had not been specially studied, it was thought desirable, in view of the positive results obtained by Ellis on the frog, to make a few additional experiments directed to this particular point. Experiments were accordingly made upon chloralized dogs, with the result of showing that feeble irritations differed from strong ones in the extent but not in the character of the movements produced. Nothing resembling a dilatation of the glottis could be produced by diminishing the intensity of the stimulus.

When this point had been reached in the study of the question, a paper entitled "The Function of the Recurrent Laryngeal Nerve," by F. Donaldson, Jr., B.A., M.D., appeared in *The American Journal of the Medical Sciences* for July, 1886. In this paper the writer gave an account of experiments on dogs similar to those made by Hooper, but leading to different results, for Donaldson, though unable to obtain the above described "ether effect," did observe a dilatation of the glottis when the recurrent nerve was irritated with *very weak* stimuli. This observation is, therefore, precisely in harmony with Ellis's results obtained upon frogs, and if confirmed would lead to the conclusion that the "ether effect" is in these cases also an effect of partial paralysis.

Shortly after the appearance of Donaldson's article a paper was read at the meeting of the British Medical Association in Brighton, entitled "On an Apparently Peripheral Differential Action of Ether upon the Laryngeal Muscles," by Felix Semon, M.D., F.R.C.P., and Victor Horsley, B.S., F.R.S. The authors were able to confirm the results of Hooper's experiments as to the effect of ether on the recurrent laryngeal nerve, and even gave a graphic representation of the "ether effect" studied by means of a rubber bulb inserted between the vocal cords. They explained Donaldson's failure to obtain the "ether effect" on the supposition that the animal was not sufficiently etherized. They also repeated Donaldson's experiments with currents of varying strength and obtained similar results in those cases in which the animal was not deeply under the influence of ether.

In view of these somewhat discordant results a renewed investigation of the effect of electrical irritation of the recurrent laryngeal nerve, with and without narcotics, seemed desirable, and Dr. Hooper is now engaged in a series of experiments which it is hoped will shed further light upon the subject.

The detailed results of these experiments will be published on some future occasion, but at the present time the following preliminary statement may be made.

It has not been found possible in these experiments to obtain a dila-

tation of the glottis by any stimulation of the recurrent laryngeal nerve unless the animal is under ether.

When the animal is etherized, the effect of irritating the nerve varies with the depth of the narcosis and the strength of the irritation.

If the animal is thoroughly under the influence of the drug dilatation of the glottis is produced by irritations of all intensities. In less profound etherization dilatation is still obtained with feeble irritation, but gives place to constriction when a stronger stimulus is applied.¹ As the effect of the ether passes off constriction occurs with feebler and feebler intensities until, finally, dilatation can no longer be obtained, and constriction is produced by irritation of all intensities.

The observation of Donaldson that dilatation is produced by feeble and constriction by strong stimuli is, therefore, correct *for a certain stage of etherization*, but for *unetherized* animals his statement has not been confirmed. The cases in which Donaldson has recorded a dilatation as a result of feeble stimulation are those in which the animal had been previously etherized, but was supposed to have recovered from the influence of the drug. In view of Hooper's failure to obtain dilatation on unetherized dogs, it seems probable that in Donaldson's cases the drug had not been completely eliminated.

It will thus be seen that, while the "ether effect," as shown on the sciatic nerve of the frog, may be explained as a partial paralysis of the nerve by the drug, the same explanation cannot be given of the phenomenon as manifested on the recurrent laryngeal nerve of the dog, for the action of ether cannot be imitated by feeble irritation of the nerves of unetherized animals.

The local action of ether, applied directly to the nerve, presents another point in which the two phenomena differ from each other, for the distinct "ether effects" obtained in this way by Perkins and Ellis on the frog's sciatic do not manifest themselves on the laryngeal nerve of the dog. A six per cent. solution of ether dropped upon the nerve of chloralized dogs, between the electrodes and the larynx, was found to gradually paralyze the nerve, so that stronger and stronger stimuli were needed to constrict the glottis, but a dilatation was, under these circumstances, never observed.

CONCLUSIONS.—The principal results of these various researches may be summarized as follows:

1. The ordinary effect of electrical stimulation of the recurrent laryngeal nerves of dogs is to cause constriction of the glottis, but if the animal is thoroughly etherized dilatation may be produced.

2. If the animal is partially etherized, the effect of the stimulation

¹ It will be observed that this result is in harmony with the above-mentioned observations of Semon and Horsley.

will vary with the strength of the current, a weak irritation causing dilatation, and a stronger irritation causing constriction of the glottis.

3. The more complete the etherization the greater is the intensity of the current necessary to produce constriction.

4. A similar "ether effect" may be observed when the sciatic nerve of the frog is stimulated, the ordinary extension of the leg and abduction of the toes giving place, under the influence of this drug, to flexion and adduction. It is, however, always possible to produce the ordinary effects by increasing the intensity of the stimulation; and, on the other hand, it is possible, by using very feeble stimuli, to produce without etherization the same effects which occur on the application of stronger stimuli to animals under the influence of the drug.

5. This "ether effect" on frogs may be observed both when the ether solution is introduced by cutaneous absorption, and when it is applied locally to the nerve below the point of stimulation. Hence the most reasonable explanation of the phenomenon is that the drug, by diminishing the conducting power of the nerve, causes a strong irritation applied to the nerve to become a weak irritation when it reaches the muscles.

6. This explanation cannot be applied to the phenomenon as exhibited by the recurrent laryngeal nerve of the dog, for without ether feeble irritations do not produce dilatation, and, with complete etherization, strong stimuli do not produce constriction of the glottis.

COCAINE, AND ITS EMPLOYMENT IN OPHTHALMIC SURGERY.

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SINCE the invention of the ophthalmoscope in 1851, no discovery has been made which is likely to have so great an effect upon the progress of ophthalmic surgery as that of the anæsthetic effect of cocaine upon the eye. By doing away with the necessity of general anæsthesia, cocaine has robbed ophthalmic operations of their chief element of fear, so far as the patient is concerned, and has, at the same time, relieved the surgeon of a frequent cause of anxiety, both at the time of the operation and subsequently. As a consequence of this, not only have many operative proceedings and modes of treatment, which formerly were only occasionally resorted to on account of the pain or inconvenience attending them, become matters of daily practice, but an impetus has been given to the introduction of new modes of treatment, operative and otherwise.

In this respect the introduction of cocaine will have an effect upon

ophthalmic surgery analogous to that which the introduction of general anæsthesia had upon general surgery, leading, as did the latter, to the substitution of frequent minor operations having a conservative tendency for the rarer and more radical ones. The introduction of anæsthetics, however, tended rather to discourage celerity in operating, while the employment of cocaine will have an opposite tendency.

It is early yet to see much effect in the direction of the introduction of new proceedings, the attention of the ophthalmic surgeon having been concentrated on discovering how its use affected those already well established. But already the signs of the coming change are visible. Paracentesis of the anterior chamber in iritis, the scraping away of old corneal opacities, the treatment of some forms of ulceration by the actual and potential cautery, and the cutting short of acute conjunctivitis by the application of strong astringents, are none of them new proceedings, but they were all of them sufficiently formidable to render their adoption exceptional, whereas they can now be employed in the ordinary routine of practice.

The alkaloid appears to have been first separated by Nieman¹ as long ago as 1859. Its physiological effects, when administered internally, were fully investigated by Hughes Bennett in 1873.² Its anæsthetic effect upon the mucous membrane of the tongue when applied locally had already been noticed by Schroff in 1862, in a communication which he made to the Medical Society of Vienna, but it does not seem to have occurred to anyone at that time that its anæsthetic properties could be turned to any account. The first suggestion to this effect appears to have been made by von Anrep, in 1880,³ who experimented both by means of subcutaneous injection and by applications to the tongue. To Koller,⁴ of Vienna, is, however, certainly due the credit of having first made definite experiments with the view of ascertaining whether the alkaloid had the same effect on the ocular as on the buccal mucous membrane. And it is to the result of these experiments that we are indebted for its introduction into practice.

The plant from which the alkaloid is obtained—the erythroxyton coca—is a native of South America, and there is a plentiful supply of the leaves, but the quantity which can be extracted from them is very small, being only one-fifth per cent. from the best. The following is said to be the best mode of separating the alkaloid:⁵ Digest the leaves (the smallest being the best) within distilled water at a temperature of 60°–80° C., filter, and precipitate with acetate of lead. The excess of lead is removed with sulphate of soda and the filtrate is shaken up with ether. To clarify it water and hypochloric acid are added; it is then filtered, precipitated by carbonate of soda and crystallized out with hot alcohol. The alkaloid is soluble in alcohol, chloroform, and ether.

Cocaine was not appreciated in England quite as soon as in America;

this was partly due to the statements with regard to its anæsthetic effects having been received at first with some incredulity, and partly to the great difficulty which was at first experienced in obtaining a supply. Dr. Benson was one of the first to employ it, he having obtained some from America through a private source, but his first experiments do not seem to have impressed him very favorably for, in his first communication to the Ophthalmological Society,⁶ he only hinted doubtfully that it might prove useful in some minor ophthalmic operations. Shortly afterward, however, it was freely used in all directions, and it was soon found that a discovery of the very first importance had been made.

We propose to consider: First, its physiological effect when applied to the eye. Second, its employment in ophthalmic surgery. Third, some occasional injurious effects.

PHYSIOLOGICAL EFFECT.⁷—(a) Applied to the eye it produces mydriasis, but this differs in several respects from that due to atropia.

The actual dilatation is often greater, although this is very variable, but the activity of the pupil to variations of light is retained. When as great a dilatation as possible has been produced by a single instillation of atropine, cocaine will increase it; the mydriasis from cocaine alone, on the other hand, is not increased by atropine. The excess of mydriasis produced by the cocaine is subject to the influence of light. By repeated instillations of atropine, however, a full mydriasis can be obtained which cannot be increased by cocaine.

The mydriatic effect, however, is extremely weak, for if equal proportions of eserine and cocaine be employed the mydriasis does not differ from that produced by eserine alone. In order that the two drugs should neutralize each other it is necessary that twenty-five parts of cocaine should be employed to one of eserine.

The mydriasis which follows paralysis of the third nerve is further increased by cocaine. When in rabbits the cervical sympathetic has been divided cocaine applied to the eye ceases to have any effect upon the pupil. In a patient of Jessop's who had all the symptoms of paralysis of the cervical sympathetic, repeated instillations of cocaine had no effect upon the pupil, but homatropine acted in the usual way.

When cocaine is applied to only one part of the cornea, the mydriasis is sometimes partial, affecting only the corresponding portion of the iris.

A drug may produce mydriasis by paralyzing the sphincter or the nerves supplying it, or by irritating the dilator fibres or their nerves. That cocaine does not act by paralyzing the sphincter or the branches of the third nerve which supply it, is evident from the retention of its contractility to light, and from the action of cocaine when the third nerve is paralyzed. It does not act directly upon the muscular fibres, or the sphincter, which is the stronger, would predominate. We are driven, therefore, to the conclusion that it acts upon the dilator fibres

of the sympathetic, and its inactivity when the sympathetic has been divided is consistent with this.

Additional proof that the action on the iris occurs through the medium of the sympathetic is afforded by the results of Pflüger's experiments on birds.²⁷ In these the sympathetic nerve supplies the bloodvessels of the iris but not the dilator fibres, the latter receiving a special branch from the trigeminus. When the cervical sympathetic is divided above the superior cervical ganglion there is increased vascularity of the conjunctiva but no alteration in the pupil; and cocaine has no effect upon the pupil in birds, although it acts as an anæsthetic.

Cocaine mydriasis passes off in less than twenty-four hours. According to Jessop the dilatation of the pupil is very great and is quickly produced. According to the writer's experience, however, the action of cocaine varies very much in this respect in different individuals, and without corresponding variations in its anæsthetic effect. Occasionally he has seen complete anæsthesia produced with hardly any dilatation of the pupil; this, although exceptional, was not more so than full mydriasis.

(b) Another noticeable effect of cocaine is the widening of the palpebral fissure, this is due to retraction of both lids, but the effect is usually more marked in the upper. Jessop found that it still occurred if the orbicularis was paralyzed; it can, therefore, only be due to contraction of the involuntary fibre muscles of Müller, which are supplied by the sympathetic.

(c) Cocaine also causes contraction of bloodvessels, as might be expected from its action upon other sympathetic nerves: as the result of this there is often marked anæmia of the conjunctiva, and probably the great diminution in the amount of lachrymal secretion is due to the same cause. Upon vessels that are dilated from inflammation, however, it has little or no effect; probably this is because the power of the muscular coat of the bloodvessels is mechanically interfered with when the dilatation is excessive.

(d) The lowering of the intraocular tension, and the consequent flaccidity of the cornea which occurs in the cocainized eye is probably due to the contraction of the bloodvessels causing diminished intraocular secretion. There is reason to believe that at the same time the lymph spaces of the cornea contain less fluid, and its absorbent power is consequently increased; this will be referred to again in considering the occasionally injurious effect of cocaine.

(e) From a practical point of view the anæsthetic effect is, of course, the most important. There can be no doubt that it acts directly upon the nerve terminations, and is not due, as formerly supposed by Everbusch,⁸ to the contraction of the arterioles, and resulting anemia. This is evident from the following facts: its action is very local, it acts with equal efficacy upon vascular and non-vascular structures, its anæsthetic

effect upon non-inflamed eyes does not vary with the anæmia produced, and the rapidity with which different structures are affected varies with the ease with which the cocaine reaches them. The sensibility of the conjunctiva and cornea are lost first, that of the iris not till the drug has reached the aqueous. As the result of numerous experiments in squint operations the writer has come to the conclusion that cocaine dropped upon the conjunctiva has little or no effect upon the sensibility of the muscles, but that it acts well and quickly if injected subconjunctivally.

Dr. Howe⁹ has made some very ingenious and instructive experiments with the view of measuring and expressing numerically the anæsthesia produced. The basis of these is the well-known fact that the irritation of a sensory nerve causes a rise of blood-pressure throughout the body. A rabbit is taken and curarized to eliminate muscular contraction, which would otherwise influence the blood-pressure, and artificial respiration is carried on by means of a special apparatus, which insures its rhythmical performance, and whose effect upon the blood-pressure is a constant factor. A mercurial kymograph provided with a self-recording apparatus is then connected with the crural artery. A tracing is first taken to find the normal blood-pressure, which shows rhythmical variations corresponding to the heart's action. One eye having been cocainized, irritants of various kinds are applied successively to both, and the differences in the effect upon the blood-pressure noted.

The minimum dose required to produce any anæsthetic effect in the rabbit was a single drop of a 0.04 per cent. solution. The maximum effect of a 2 per cent. solution was attained on an average after a quarter of an hour and was as great as that of a 5 per cent. solution.

These experiments do not pretend to be exhaustive, but they open up a new field for investigating the action of cocaine; unfortunately this is forbidden ground to most in England.

The anæsthetic effect of cocaine upon eyes of which the deeper tissues are inflamed is very slight, probably this is in part because absorption in such is slow, and in part because there is hyperæsthesia. Often, however, it produces a marked effect in conjunctival inflammation when the photophobia is excessive as compared with the hyperæmia, the condition so often seen in the commencing catarrhal ophthalmia in young children. In such the writer has found that cocaine has immensely facilitated the examination of the eye.

CLINICAL USES.—Incidentally several of the conditions under which cocaine can be utilized have been mentioned, and others can be inferred from what has been said. Broadly speaking, one may say that it will produce sufficient anæsthesia for any operation, when it can be brought into contact directly or by absorption with the parts implicated. The fact that the iris retains its sensibility longer than the cornea, has led to the suggestion that it should be injected into the anterior chamber either

at the commencement of the operation, or after the corneal incision has been made. There are, however, obvious objections to this, and quite sufficient anæsthesia of the iris is produced by repeated instillation into the conjunctival sac. A local anæsthetic would be extremely useful for squint operations, since the retention of muscular contractility is of great assistance in gauging the effect produced. The writer has, however, found cocaine extremely uncertain in its action in these cases. When injected beneath the conjunctiva it acts well and promptly, but the chemosis which is produced is a decided inconvenience.

The use of cocaine, however, in ordinary ophthalmic operations is so general, and experience as to the immense advantages it possesses is so uniform, that it will be better to pass at once to the consideration of its employment in ways which are less generally practised, and to discuss in what direction practice is likely to be influenced by its introduction.

The treatment of ulcers of the cornea is likely to be modified in several respects. In the recurrent vascular ulcer, in which a single leash of vessels runs up to the ulcer the writer has found much good follow from the division of the vessels,—a proceeding which is not new, but one which could only be practised in exceptional cases when general anæsthesia was necessary. Mr. Carter's suggestion¹⁰ also of treating some forms of ulcer by the application of nitrate of silver is an extremely valuable one if care be taken that the application is strictly localized. Cocaine renders this easy by preventing the reflex lachrymation, and at the same time putting the eye completely under control. Lately the writer in cases of pannus in which the vessels are not too numerous, has adopted the plan of obliterating the several vessels, but touching them just beyond the corneal margin with a very fine point of nitrate of silver, and has so far been well satisfied with the results. Paracentesis for pain in iritis is another instance of most successful practice, which has been rendered easy.

It remains to be seen how far the property which cocaine possesses of lowering tension can be utilized. Hitherto it has not been used in glaucoma except in conjunction with eserine; indeed, its mydriatic effect would probably counteract any beneficial effect that it might otherwise have, and as the eserine has always been used in quantities more than sufficient to counterbalance the merely mydriatic effect of the cocaine, it is impossible to say how much effect the cocaine had upon the tension.

In iritis the combination of cocaine and atropine has been extensively used, and, it is thought, with good results. Jessop has shown that these drugs together produce full mydriasis in the normal eye, more quickly than either of them alone. The dilating power of the cocaine is, however, so feeble that it is doubtful whether it can assist much in overcoming an adhesion.

In the cases of irritable conjunctiva in which there is excessive lachry-

mation of the eyes on exposure to cold, wind, etc., without any obvious cause to account for the symptoms, the writer has attempted to turn to account the power which cocaine possesses of diminishing secretion; but although the trouble diminishes while the cocaine is being used, he has not seen any permanent relief produced.

INJURIOUS EFFECTS.—That so potent a drug should occasionally produce injurious effects is no matter of surprise, and numerous instances have now been recorded in which cocaine applied to the eye, or injected, has been followed by local lesions, and by general toxic symptoms. Some of these are, no doubt, to be explained by impurities in the drug, an excessive and unnecessary concentration of the solution employed, and individual idiosyncrasies; deducting these, however, there still remains a residuum of cases in which cocaine undoubtedly produced bad local or general effects.

In almost the first case in which the writer used cocaine, the patient—a lad of fourteen—turned pale, and broke out in a profuse perspiration, a few minutes after the instillation of a single drop of a four per cent. solution, the pulse became very small and slow, and the lips bluish. Ammonia was administered and the patient made to lie down, but it was nearly an hour before he recovered from the condition of partial syncope. These symptoms might have been due to fright, but the patient did not show any signs of nervousness. In another case¹¹ the instillation of about fifteen drops of a two per cent. solution in a girl of twelve, was followed by severe pain in the head, dryness of the throat, marked malaise, tottering gait, and a difficulty in speaking as if the tongue were paralyzed. The symptoms lasted thirty hours.

The majority of the cases, however, have been elderly people, generally badly nourished. In three cases recorded by Bellarminoff,¹² vomiting persisted for several hours.

In the following case the repetition of the symptoms each time that the cocaine was used, leaves no room for doubt that they were really due to it.

In a woman,¹³ aged seventy, with pulmonary emphysema, six to eight minims of a two per cent. solution were instilled, and cataract extraction performed; delirium came on which lasted for several days. A discission was performed eight days later for which three drops were instilled; great dyspnœa followed: this may, however, have been due to the previous condition of the lungs. On the following day six minims were instilled (for what purpose is not stated): dyspnœa, vomiting, and complete loss of appetite followed. Finally, cocaine was used for a needle operation on the other eye, when the same symptoms followed, although they were less severe since the dose was reduced.

When cocaine has been injected subcutaneously the symptoms have occasionally proved very alarming, as in the following case:

A woman, aged twenty-eight years,¹⁴ strong and healthy, and not of a nervous temperament, applied to a dentist for the extraction of a tooth; he injected into the alveolus six minims of a twenty per cent. solution, and performed extraction without pain. About ten minutes after the injection the patient was noticed to have a staring appearance, and complained of dulness of vision. Soon she said that it was quite dark, and almost immediately fell back unconscious. When seen by Dr. Schubert, half an hour after the injection, she was lying in a dreamy state with the eyes half open, and could not be roused. The pulse was 80, full and strong. The arms were relaxed, the pupils of medium size, and active. There was no reflex movement on touching the conjunctiva or on pricking the face. Subcutaneous injection of ether produced no effect, but the inhalation of a drop of nitrite of amyl produced an immediate improvement. The patient now moved on being shaken, and answered at first at random, but soon rationally. Complete recovery soon followed, and she was able to go home an hour and a half after the injection. No after-effects followed. The ophthalmoscope was used as the patient was recovering, and the retinal arteries were thought to be somewhat smaller than at a subsequent examination.

Syncope¹⁵ from failure of the heart's action also occurred in a case in which a ten per cent. solution was injected into the skin previous to opening an abscess.

The local troubles which have followed, and been attributed to the application of cocaine to the eye are of two distinct kinds—suppurative panophthalmitis and affections of the cornea.

Heuse¹³ saw panophthalmitis follow the excision of a prolapsed iris with the application of the galvanocautery under cocaine, and Bell-Taylor,¹⁶ Nettleship, and MacHardy¹⁷ have reported series of cases in which suppuration has followed cataract operations in which it was employed. One must, however, be cautious of attributing these results to the cocaine. Cases of suppuration do occasionally occur in groups, and all recent investigations into the cause of suppuration in wounds of the eye tend to point to infection of the wound as the probable cause; this might be brought about through the medium of the atmosphere, instruments, etc., or by microörganisms introduced with the cocaine.

In some cases solutions, and in others disks were employed. Fungi often appear in the former when kept too long; while the latter very readily absorb moisture from the air. If, therefore, the suppuration was in any way connected with the cocaine, it was due, probably, not to any direct effect of the alkaloid, but to germ-infection.

We shall presently see that cocaine increases the absorbent power of the cornea, and in this way increases the probability of infection occurring, a fact which renders it doubly important to avoid operating with cocaine during the existence of any conjunctival catarrh.

Corneal lesions have occurred much more frequently, and there need not be the same hesitation in attributing them to the action of the cocaine, since they immediately follow its use, have been known to do so when the solutions used were free from bacteria, and are not known to occur under other conditions. These lesions are of two kinds, epithelial and interstitial, which may be associated, but are not necessarily so.

The first affects the surface of the cornea; this becomes slightly dull and rough, like the finest ground glass; and when touched with the finger, and sometimes spontaneously, the epithelium peels off. Sometimes this desquamation is preceded by vesication. Everbusch⁸ was the first to describe this change; it occurred in a healthy young man, whose cornea was perfectly normal, and who was about to undergo an operation on the eyelids, and in a child of ten with squint. Bunge¹⁸ describes four cases, all in elderly people, in which there was loss of the epithelium over a considerable area of the cornea; in none did any ill-effects follow. The writer has seen several such. One of these was a case of divergent squint, in a girl of eighteen. There was an old corneal opacity, but the eye was otherwise healthy. After the fifth instillation of a drop of a five per cent. solution of the hydrochlorate of cocaine, the conjunctiva below the cornea was seen to be slightly swollen; to present a very faint blush; at the same time the cornea looked dull and dry, as is seen in advanced glaucoma. On touching it with the finger the epithelium peeled off over an area of about three millimetres diameter. The operation was performed, and the next day the cornea had resumed its normal appearance.

Much more serious are lesions of the true corneal tissue. Pflüger¹⁹ records the case of a man, aged sixty-seven, in whom he used a two per cent. solution for an iridotomy after cataract extraction. The wound healed well, but a week after the operation the cornea was still completely anæsthetic, T. —3, and there was ciliary injection. "Typical neuroparalytic keratitis" now came on, and vertical stripes of opacity appeared, deep in the cornea, looking as if they were caused by wrinkling of Descemet's membrane. The constant current was applied, and sensation returned after three applications. By the twentieth day the cornea had almost cleared. There was some anæsthesia of the other eye also, but this was attributed to tight bandaging. The length of time that elapsed before the corneal changes supervened, renders it possible that they were independent of the use of cocaine, but this objection cannot be urged against six cases reported by Bunge,¹⁸ in which a parenchymatous opacity appeared, consisting of vertical stripes extending across the cornea from the wound.

Somewhat different from these cases are five cataract extractions reported by Dr. Wood-White.²⁰ He had frequently used cocaine, in combination with boracic acid as an antiseptic, but in these five cases he

had substituted a solution of corrosive sublimate for the boracic acid. In all of these there was seen on the second day a pearly-white opacity of the cornea, which in one instance was sufficiently dense to conceal the pupil. The cornea cleared in all.

From the fact that such results have not followed the use of corrosive sublimate in the practice of others, nor that of cocaine in his own, Dr. White concludes that they were due to the simultaneous action of the two drugs, the cocaine in some way rendering the cornea more susceptible to the action of the sublimate. We shall see presently that this hypothesis has since received some confirmation. It should, however, be observed that Dr. White's cases stand on rather a different footing to those already quoted. The fact that the complication occurred in all his cases, while in the hands of others (some of whom certainly used cocaine and sublimate together) the complication is rare, suggests the suspicion that there was some peculiarity in the solutions used by him. The strength of the sublimate solution is not stated, nor is it stated whether the same was used alone in other cases. The opacity does not seem to have had the striated appearance described in the other cases, and cleared up more rapidly. It is, therefore, quite possible that the cocaine had nothing to do with the opacity, and that it would have appeared if the corrosive sublimate had been used alone.

As regards the cause of the vesication and desquamation of the corneal epithelium, Dr. White suggests that the corrosive sublimate may have something to do with this also; but this is certainly not so, for in the writer's case, and in some others, cocaine was used alone. Everbusch (*loc. cit.*) suggested that it might be due to the dryness of the cornea which the cocaine caused, by keeping the lids open, and thus favoring evaporation. Experimenting on dogs, he found that if the lids were kept closed between the instillations no desquamation took place, and states that since he has adopted this precaution in operations, he has seen no instances of this complication. Later experiments of Würdinger²¹ have confirmed this. Into both eyes of a rabbit he instilled a drop of a five per cent. solution of cocaine at intervals of four minutes. The one eye was kept closed between the instillations, but not the other; no corneal changes occurred in the covered eye, in the other there was slight dulness of the cornea after three or four minutes, and twenty to twenty-five minutes after the first instillation the whole cornea presented a very fine roughness, then there appeared superficial depressions looking as if due to shedding of the epithelium, but the reflection from them was normal, and their floor showed no roughness. After the instillations had been continued for an hour, the cornea was so turbid that the condition of the iris could not be made out. To ascertain if these changes really depended upon dryness of the cornea, Würdinger next tried the effect of dropping distilled water, or lacrymal secretions, upon the cornea

between the instillations of the cocaine. This did not remove the changes which had already appeared, but it prevented their increase.

The next experiments were directed toward ascertaining whether this dryness of the cornea was accompanied by a deficiency of lymph in its substance. For this purpose succinyl fluoresceine was employed. One eye of an animal was cocainized, and, as soon as superficial changes had occurred, the fluoresceine was instilled into both eyes. In the non-cocainized eye there was produced fluorescence of the superficial layers only, which was uniformly distributed. In the cocainized eye, on the contrary, deep fluorescence appeared first, and was there more dense; the superficial and deep areas of fluorescence then coalesced.

When the epithelium was abraded over a limited area on each cornea, and methyl-blue applied in the non-cocainized eye, it merely stained the abraded portion, while in the cocainized it spread thence over the whole cornea. These experiments seem to prove that cocaine increases the absorbent power of the lymph spaces of the cornea, and, therefore, probably diminishes the lymph in those spaces.

Microscopical examination showed that in the early stage the superficial depressions were due to thinning of the anterior lamellæ of the cornea, and that in a later stage the epithelium was absent.

The results of Würdinger's experiments on the combined effect of cocaine with antiseptic solutions were of still greater importance, for he found that solutions of borax, boracic acid, corrosive sublimate, and even of common salt, which were quite innocuous in the normal condition, caused, in the fully cocainized eye, a dense turbidity of the cornea identical with the striated keratitis occasionally seen after cataract extraction.

It is important that these experiments should be repeated and extended, for should they be confirmed, it is evident that a considerable modification of the methods of using antiseptics in operations on the eye may be necessary.

Corrosive sublimate has been used very freely of late as an antiseptic in operations in which cocaine was also employed, and corneal lesions have occurred but rarely; still this is not sufficient ground for acquitting the sublimate of having a share in their production. Further information is needed as to the concentration of the sublimate that is necessary to act efficiently as an antiseptic, and as to what is the strongest solution that can be used without danger to the cornea.

The published reports of many of the cases of corneal lesion following the use of cocaine, do not state whether corrosive sublimate was also used. Many of the cases, however, occurred in countries where the latter is used almost as a matter of routine, while in England, where antiseptics in ophthalmic operations are little used, Dr. White's cases, in which it was employed, are almost the only examples of interstitial changes in the cornea.

As to the form in which it is best to use cocaine, disks are certainly the best for experimental purposes, as the quantity introduced can thus be more accurately measured. For a time it seemed as if they would be the favorite medium for clinical purposes also. Mr. Nettleship's (*loc. cit.*) statement, however, as to the frequency with which he had seen suppuration follow their use, led to their being to some extent discredited, and their hygroscopic qualities would certainly seem an objectionable feature.

The aqueous solution of the hydrochlorate is most generally used. It has a tendency, however, to become turbid when kept, from the development of a fungus, and some of the ill effects which have occasionally followed its use have been thought to be due to this. Various means have been suggested for keeping the solution clear. Everbusch suggests the following: Take equal parts of a solution of corrosive sublimate (1 to 4000) and a saturated solution of salicylic acid, mix these, and use as a dissolving medium for the cocaine. Würdinger's experiments, however, show that this combination may prove injurious, and the safest plan, at present, is to use fresh aqueous solutions.

It seems now clearly established that little is gained by using strong solutions, and that as great an effect can be procured with a four per cent., or even a two per cent., solution as with a ten per cent., although more time is requisite to obtain the maximum effect.

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A REVIEW OF TWENTY-TWO COTTAGE CASES
OCCURRING IN THE WOMAN'S HOSPITAL, IN THE SERVICE
OF DR. T. GAILLARD THOMAS.

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It has been the custom at the Woman's Hospital for several years to perform operations in which the peritoneum is exposed, or in which aseptic surroundings are imperative, in a small detached building devoted exclusively to this purpose; and the term "cottage-patient" has become distinctive as regards a class of cases including laparotomies, removal of submucous fibroids filling the vagina, laparo-elytrotomy, etc.

The following cases are all the cottage operations that took place in Dr. Thomas's service while I was senior house-surgeon at that institution. They are of special interest to some of those who watched them, as no pains were spared to carry out antiseptic methods; nothing was taken for granted, and the smallest details were subjected to the personal supervision of the writer. No one who has not toiled with this subject, can appreciate the untiring vigilance that is necessary to secure the observance of antiseptic precautions. For the sake of dealing with the subject systematically and making clear the precautions exercised, four sources may be considered from which septic material can gain access to the wound.

1st. From persons concerned in the operation.

2d. From instruments, sponges, ligatures, and sutures.

3d. From spectators and the operating-room.

4th. From the patient's person.

Under the first head come the surgeon's assistants and nurses, the hands and forearms of the operator, and his perspiration.

THE TOILET OF THE OPERATING STAFF.—All taking part in the operation wash their arms and forearms carefully with soap and water, paring the nails and using a nail-brush. The hands are dipped into a solution of bichloride of mercury (1:2000) and a basin containing a solution of the same strength is within easy reach, so that the operator may cleanse his hand from time to time, particularly before introduction into the peritoneal cavity. When time permitted, it was the custom of the writer to take a bath shortly before the operation, and the hair of the head and face should always be thoroughly cleansed.

The nurse must comply with the above-mentioned antiseptic precautions.

INSTRUMENTS.—All instruments are placed, for an hour before the operation, into 1:20 carbolic acid solution, to which an equal quantity of sterilized hot water is added when the instruments are in use. The

water is taken from the tank of a high-pressure boiler, and carried to the operating-room in demijohns.

SPONGES.—The same sponges are used continuously, and to each is sewed a piece of tape, so that it is almost impossible to overlook them when closing the abdominal cavity. After an operation the sponges are carefully washed with soap and water and then boiled for several hours. They are preserved in a glass jar with an air-tight cover, and rest upon a false bottom composed of galvanized rubber which is perforated, and stands in a solution of carbolic acid, 1 : 20. Before use they are soaked for two hours in bichloride of mercury, 1 : 1000.

If a sponge becomes friable, or is difficult to clean, it is replaced, and a new one is prepared by soaking it in a very weak solution of hydrochloric acid for several weeks.

LIGATURES AND SUTURES.—Silver wire is rendered aseptic by immersion, with the instruments, in the solution of carbolic acid before an operation.

Of catgut, that prepared by Am. Emde was used. It is preserved in oil of juniper. No. 3 is the size most used, and Nos. 4 and 5 are at hand.

The silk for the pedicle and ligatures is prepared in the following manner: A piece of solid glass rod is bent in the form of a square, and on this the ligature is rolled, so that all parts are evenly exposed to the boiling solution of 1 : 2000 bichloride of mercury, in which it is suspended for an hour. It is removed from this solution under the spray (the utmost cleanliness as to the hands being observed) and dropped into a solution of carbolic acid 1 : 40. Under the solution it is reeled on a glass spool, and finally placed in a bottle containing 3 per cent. of carbolic acid in alcohol. The bottle, cork, and glass spool are boiled with the ligature. The end of the ligature is carried through the cork by means of a carrying thread attached to a round-pointed needle; all of these articles have been rendered aseptic.

When the ligatures are to be used, they are passed to the first assistant, who pulls a portion out of the bottle, cuts it off, throws it away, and then draws out the part intended to be used. By this method no one touches the ligature except the one applying it. When silk is used for sewing the abdominal wall, as many needles as there are stitches likely to be required should be threaded on the silk. By catching the last needle threaded, holding that fast to the end of the silk, and holding the remaining needles near the cork with the other hand, the annoyance of stopping to thread the needle is avoided. They are retained under an antiseptic solution.

Three varieties of silk are used. That for the pedicle is especially made for this purpose of loosely twisted strands, and is so strong that it cannot be broken with steady traction when used with a surgeon's knot

about the pedicle. The smaller sizes are found useful to ligate vessels, and as sutures.

SPECTATORS AND THE ROOM.—The walls, flooring, and everything in the operating-room should be rubbed with a cloth wet with the chloride of lime, 1 : 10, and the doors and windows thrown open for twenty-four hours, so that there may be the freest circulation of fresh air.¹ For an hour and a half two spray apparatuses saturated the air with a solution of carbolic acid 1 : 40. The solution used is about 1 : 20, but it loses about one-half of its strength by dilution with the steam. The spray is discontinued when the operation commences.

To guard against contamination from spectators, a rope is interposed, at least three feet from the wound.

AUTO-INFECTION.—The abdominal wall is shaved low enough to prevent the pubic hair from reaching the wound, and the abdomen washed with soap and water and covered with a towel wet with a solution of bichloride of mercury, 1 : 1000. This is removed just before the operator makes his first incision.

To prevent auto-infection from cysts containing septic material, the patient is turned on the side when they are evacuated. This procedure, which, I believe, originated at the Woman's Hospital, marks an important advance in the *technique* of operations for the removal of fluid tumors. If done properly, no undesirable fluid can escape into the abdominal cavity, and it is most expeditious. There is no trocar to get out of order and to be found unsuitable.

The cottages where these operations are done have been built for a number of years, and while they were an advance at the time of construction they are not in conformity with modern surgical architecture. They are small frame buildings, about 12 x 26, divided into two equal rooms by a square hallway and closet, between which is a passage connecting the two rooms. The hallway opens at the left side into the nurse's room, in which is a large stove by which the building is heated. There are no sewer connections with these buildings. The water is carried to them in pails and the slops removed by a similar method.

Before speaking of individual cases it would, perhaps, be better, in order to avoid repetition, to mention the routine methods—preparatory, operative, and after-treatment.

The patient's general condition is improved as much as possible, iron and a bitter tonic, and as much sunlight and fresh air as can be taken without causing fatigue. A vaseline bath is given every third night, and the bowels thoroughly evacuated, commencing the catharsis at least one week before the operation. The habits of the patient are taken into

¹ The cleansing of the room was not always as thoroughly done as it should have been owing to the exigencies of the hospital management.

account as to the cathartic selected, but care is taken to avoid active catharsis two days prior to the operation, so that the patient may not be prostrated. The urine is always examined when the patient enters the hospital, and, if loaded with urates, an alkali largely diluted is used. Lithia water, or acetate of potassium (Zss-Oj), to which is added iron if it be required, is found of service.

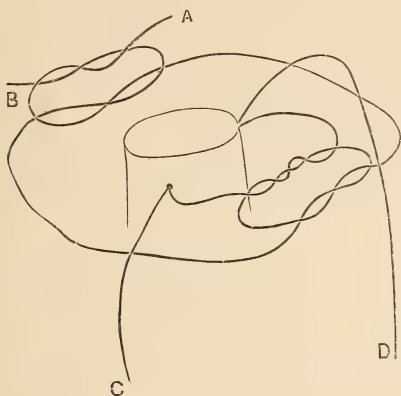
The patient is dressed with thick flannel drawers, stockings, and undershirt, and a blanket is pinned about the lower extremities. These are made to hang over the foot of the table by flexing the legs, and the feet are placed on a rest provided for that purpose. A towel wet with 1 : 20 carbolic acid rests on the blanket.

The operator stands to the right of the table facing his first assistant, on the other side of the patient. The second assistant stands a little back of the first, and between him and a table holding the submerged instruments, and has in his hands a tray with antiseptic fluid containing those instruments for immediate use. Two nurses stand to the left of the operator. One takes the dirty sponges and drops them into a six-gallon pail of hot water. After the blood and serum are washed out they are dropped into a similar pail containing a hot solution of bichloride of mercury, 1 : 4000. The second nurse holds them ready for use in a basin so that the operator can quickly change. If a sponge should fall to the floor it is not used again. A third assistant is responsible for the cautery iron, the Paquelin cautery, and electric light for the abdominal cavity.

Dr. Thomas's method of opening the abdominal cavity is as follows: An incision, three and a half or four inches (the tissues will contract so as to make the length about two inches), is quickly made to the *linea alba* or transversalis fascia. While the *linea alba* is the objective point, a slight variation to one side or the other is disregarded, and the cut continued directly through the muscle. The peritoneum is raised with a fine tenaculum, and snipped with scissors. A director is then introduced and the opening enlarged as desired. Hemorrhage has been checked by Péan's or Well's forceps before the peritoneum is incised. A digital or manual examination of the cavity can now be made. If a cyst is to be evacuated, the patient is turned on the right side, and after securing the sac with Nélaton's cyst forceps, an opening is made by the knife or scissors—a trocar may first be used. If there are endogenous cysts, these are broken up by the hand introduced into the opened cyst cavity. The abdominal cavity has been closed from the external air by sponges about the pedicle in the meantime, and the patient is again turned on her back.

In removal of the uterine appendages the patient is not turned on her side, unless gravity is desired to enable a pus-filled tube (or something of this nature), if accidentally broken, to drain itself on a sponge.

This diagram shows the method of securing the pedicle. The strands *A* and *B* are adjusted and need only be tightened to be secure. *C*



and *D* are merely passed through the stump. They are tied in the same manner as *A* and *B*, with the exception that they pass about the upper half of the stump first. By this method each ligature passes once half and once wholly about the stump, so that it is entirely encircled thrice.

In closing the abdomen, three or four silver sutures pass completely through the abdominal wall, including peritoneum. The edges of the peritoneum are united by a continuous catgut suture, the muscles and fascia by the same thread, and finally, the skin is approximated more exactly by catgut than has been done by the silver sutures.

After sewing the abdominal wall together, the wound is covered with collodion, and before this dries well dusted over with iodoform; over this is placed a piece of iodoformized gauze, and then a number of narrow strips of adhesive plaster to give additional support in case the patient vomits, coughs, etc. This is covered by a roll of cotton batting, and the body encircled by a binder.

THE AFTER-TREATMENT.—After the operation has been completed, the patient is placed in bed, where there are several water cans covered with flannel by the sides and at the feet. The room is darkened, and no one permitted near but the nurse, who is directed not to talk to the patient. If there is much pain it is controlled by compound solution of Magendie hypodermatically administered. A few small pieces of cracked ice may be held in the mouth, or two or three drops of lemon-juice to overcome nausea. I think that washing out of the stomach, immediately after the operation, in all these cases would prove most useful.

If the patient is in fair condition, no attempt to administer nourishment is made for twenty-four hours, and if quite strong, nothing is given for thirty-six hours. If by this time the gas has been passed freely, and there is no pain, a tablespoonful of milk or chicken-broth and lime-

water is allowed every four hours, and an enema of beef peptonoid, half a drachm added to milk with a little liquor opii is given every four hours, alternating with the milk. Stimulants are used by the rectum, if indicated. No solid food is allowed until the sixth day. The pulse, temperature, and respiration, are taken every four hours, and if the nurse is skilful this can be accomplished without disturbing the patient. The temperature is taken in the vagina.

I wish to make my acknowledgment to Dr. Thomas Keith, of Edinburgh, for his kindness in communicating to me his practice in this important stage of these cases.

CASE I. *Commencing malignant disease of the uterus; removal of diseased tissue; recovery.*—Mrs. K., æt. forty-four; no children; last miscarriage twenty-seven years ago. Principal symptom has been a bloody discharge for six months, which has of late been very offensive. Dr. Thomas sent her to the hospital with the diagnosis of commencing malignant disease. Her general condition is excellent.

Sept. 26. Dr. Thomas drew down the cervix with a stout tenaculum, and removed a cone-shaped mass, including the diseased tissue, with a pair of sharp-pointed scissors slightly curved on the flat. The uterus was thus shelled out. On account of the hemorrhage it was necessary to apply two heavy silk ligatures at right angles, running up in the axis of the uterus, to draw together the bleeding surfaces. A number of smaller ligatures were used. Ligatures left hanging into vagina, and a tampon soaked with bichloride solution, 1 : 2000, used. This was removed on the third day, when there was a slight odor.

Oct. 14. All ligatures have come away. The discharge, which has been quite offensive, and required frequent douchings, has now markedly diminished. Patient sitting up.

25th. Patient left hospital.

Jan. 1886. Dr. Thomas heard from patient, who is feeling very well; no return of discharge.

CASE II. *Ovariectomy; recovery.*—Mrs. K., æt. twenty-three; no children; no miscarriages. About six months ago noticed general enlargement of abdomen. She has had no pain, but felt a dragging sensation in loins on assuming the erect posture. No other symptoms except vesical irritability and slight increase in monthly flow. Examination revealed a thin-walled cyst; fluctuation readily obtained, and equal in all directions. Uterus retroflexed and carried to the right.

Oct. 3. Dr. Thomas removed an ovarian tumor weighing $14\frac{1}{2}$ pounds, in a little less than ten minutes. The left ovary presented several small cysts, which were punctured; also a small pedunculated fibroid, which was removed after its pedicle had been ligated. The ovary was then returned.

When the patient entered the hospital, at the right apex was heard high pitched and prolonged expiration, and the patient gave a history of cough for several months. In the second week after the operation, there were abundant râles at the right apex and free expectoration. The evening temperature would run as high as 103° , and the patient complained of severe sweats in the afternoon. Treatment: Fresh air, as much food as could be digested, stimulants, etc. The active process stopped finally, and March 1, 1886, she wrote that she was doing nicely.

CASE III. *Ovariectomy; death*.—Miss H., æt. fifty-one. Noticed general abdominal enlargement for one year—distinctive tumor appreciated two months ago. Principal symptom is pain on left side and inconvenience of tumor mass. General condition poor.

Oct. 17. Dr. Thomas removed an ovarian tumor from the right side. There were a few strong adhesions but no other complications.

21st. The patient died; the cause of death is unknown. The pulse had been very weak but not particularly rapid until the afternoon of this day, when the temperature ran up to 106° F., and the pulse to 130. She was comatose for a couple of hours before death. The autopsy showed much fat about the heart, but the fibrillæ were not affected. The patient had passed a fair amount of urine and it contained no albumen. There had been some oozing from the stump, not more than an ounce of odorless, fluid blood was found.

CASE IV. *Hegar's operation; recovery*.—Miss S., æt. thirty-two. Menstruation has been quite profuse, and the patient suffers greatly from abdominal pain. The symptoms arise from the weight caused by a large mural fibroid. She is a factory girl, dependent on her own exertions for a living.

Oct. 10. Dr. Thomas performed Hegar's operation, removing the ovaries without the tubes. The peritoneum was closed by continuous catgut suture; the pulse and temperature rose gradually after the operation, and emesis was continuous. On the second day after the operation the pulse was 138, temp. 102.5° F., resp. 14, and the patient was vomiting incessantly. On the fourth day the temp. was 105° F., and pulse 152. On the morning of the fifth day the abdomen was reopened, but nothing found. From this time the patient made a good recovery. A mural abscess developed a few days after the abdominal cavity had been reopened, but no local tenderness at that time existed, although it was carefully sought for.

August, 1886. Examination by the writer showed that the mass was smaller, but nodules could now be detected that were not before apparent. Patient says she has very much less disturbance, and is sure the mass is much smaller. The nodules that are now apparent were probably present before the operation, but atrophy in some portions of the tumor has changed its position.

CASE V. *Removal of the ovaries and tubes; recovery*.—Miss H., æt. twenty-four. Has suffered intensely at her menstrual periods for years. She was under treatment for a long time at her home in the West, and as a last resort was sent to New York City. The ovaries were enlarged, tender, and prolapsed.

Oct. 10. Dr. Thomas removed the ovaries and tubes. The patient made a good recovery; there was no complication. June 2, 1886, she writes: "I can endure a great deal of exercise with very little fatigue, and feel better than ever before in my life."

CASE VI. *Ovariectomy; recovery*.—Mrs. D., æt. thirty-four; seven children. One miscarriage three years ago. Two years ago her abdomen commenced to enlarge, and she has lost a great deal of flesh in the past seven months. Suffers from pain in the side for the past six weeks. Examination made evident the signs of a simple cyst.

Nov. 21. Dr. Thomas removed a large ovarian tumor from the left side. There was a varicose condition of the veins of the broad ligament, some being as large as one's thumb. The right ovary was normal. Time of operation twelve minutes. There were no after-complications.

I heard from the patient several months after the operation and she was doing bravely.

CASE VII. *Removal of fibroid; recovery.*—Mrs. W., æt. forty-three; no children; no miscarriages. Has flowed excessively for a year. Was in the hospital five months previously, and Dr. Thomas diagnosticated a large fibro-myoma of the uterus of the submucous variety. He thought it was best to wait at that time, and in the meanwhile to have the patient carefully watched. He thought that by delaying, the pedunculation would be more fully accomplished. When she presented herself at the hospital the second time, she was so weak and anæmic that a fainting fit would follow an attempt to assume an upright posture. The fibroid filled the vagina, and from pressure, and poor nutrition, it had commenced to slough on its external surface. Her principal symptoms at this time were vesical irritability and dragging pains. She had had morphine for the past two weeks.

Oct. 28. Dr. Thomas removed the mass by the vagina piecemeal, with a very powerful pair of scissors; at times cutting with the greatest care, and at others removing boldly pieces as large as half a kidney. The mass altogether weighed a little less than three pounds, when the blood had drained away. The patient was very weak, and the hemorrhage was controlled by steady traction on the uterus with a stout tenaculum, held by the writer.

February 25, 1886, this patient writes: "I am gaining strength and flesh very rapidly."

CASE VIII. *Removal of fibroid; recovery.*—Mrs. K.; laparotomy and removal of a fibroid tumor and drawing up the vaginal wall to cure a vaginal hernia. This case is reported in full by Dr. Thomas in a paper read before the Academy of Medicine, December, 1885, and published in the *New York Medical Journal*, December 26th of the same year.

CASE IX. *Removal of dermoid cyst of ovary; recovery.*—Miss McC., æt. twenty-six; has suffered more or less pain for months. Has had slight vesical irritability for years. Examination shows a large mass wedged in the pelvis. The uterus is thrown forward and crowded up against the symphysis pubes, and measures four and a half inches in depth. The mass felt so hard, that the writer thought it was a fibroid of the posterior wall of the uterus.

Nov. 9. Dr. Thomas removed a dermoid cyst of the left ovary. The contents consisted of reddish hair, several imperfect teeth, and a large mass of fatty fluid. The right ovary and tube removed on account of cystic degeneration in the ovary.

Complications: A large mural abscess; otherwise made a good recovery. Have heard of the patient through others within the past five months, and she is doing well.

CASE X. *Ovariectomy; recovery.*—Mrs. F., æt. thirty-four. Two children, youngest twelve years of age. She has suffered from digestive derangements and bearing-down pains for about a year, and for the same time has noticed two lumps in the abdomen side by side. Examination revealed two dense cysts connected to the uterus and each other.

Nov. 9. Dr. Thomas made the usual incision. There were dense adhesions in all directions, and after working to the side, a slate-colored cyst wall presented. The cyst was evacuated in the usual manner. The adhesions to the small intestine were very numerous. These were broken

up as gently as possible by the sponge and the fingers, and the cyst removed. Below the position of the cyst, and to the right, was discovered a smaller papillomatous mass about the size of an orange. After much difficulty, on account of hemorrhage, this was removed. It proved to be the right ovary. A large number of silk ligatures were left in the abdominal cavity, and a long glass drainage tube was used.

On the seventh night the tract of the drainage tube was washed out carefully, and, afterward, twice daily, as the discharge was quite large in amount, and rapidly became offensive when not thoroughly cleaned. The temperature could be maintained nearly normal by this means.

This patient has been under my care since the operation, on account of a fistulous tract that has not yet entirely closed. This is probably due to a ligature, and as it gives her very little inconvenience, I have advised her to wait patiently until it comes away. I am the more inclined to give this advice, as I have known of a somewhat similar case where death followed operative interference.

CASE XI. *Ovariectomy; recovery*.—Mrs B., æt. fifty-one, no children, five miscarriages; the last, five years ago. Menstrual flux normal. She was tapped five months ago for dropsy, but the relief was of short duration. First noticed increase in size one year ago. The principal symptoms are great emaciation, and discomfort from the presence of a large cyst.

Nov. 4. Dr. Thomas removed a large ovarian cyst; there were no adhesions, and the patient made a good recovery. The temperature was never above 100° F. I heard from the patient nine months after the operation, and she felt very well.

CASE XII. *Abdominal abscess; laparotomy; recovery*.—Mrs. K., æt. twenty-three; no children; suffering from hectic for past six months. Abdominal cyst discovered. It was thought to be an abscess.

Nov. 21. Dr. Thomas made the usual incision. When the peritoneum was reached everything was found matted together. On opening the abdominal cavity, a slight tear made an opening, through which welled up stinking pus. Dr Thomas seized the sac with a tenaculum, and held it so that not a drop escaped into the abdominal cavity. There was over a quart of this offensive purulent fluid. The wound was washed out with a solution of mercuric chloride, 1 : 4000, and the wound closed after the sac was securely fastened to the abdominal wall. A long glass drainage tube was left projecting from the sac. The cavity had been closing up so nicely from the bottom, that when she left the hospital a two and a half inch tube was substituted for the original one of six inches.

The sac was kept clean by repeated antiseptic douches. The temperature was taken every four hours, and if above 100° F. the interval between the washings was diminished. It was done on some days every second hour. The discharge continued sweet after the first few washings. The patient had been much run down before the operation, but improved so much afterward that she became impatient because of the restraints of the hospital, and took "French leave."

CASE XIII. *Removal of uterine appendages; recovery*.—Miss M., æt. thirty-three. She has suffered from pain in her left side, particularly at the menstrual periods, until life has become a burden. She is a school-teacher, dependent on a salary for her maintenance, but is unable to do any work at the time of her periods. She has undergone varied treatment from many physicians, but with no benefit. The uterus, which is

retroflexed, was at one time replaced forcibly, while the patient was etherized, but, as might have been expected, she was not relieved.

Nov. 25. Dr. F. P. Chambers removed both ovaries and tubes. No complications except that a small cyst ruptured in removing the right ovary, but the fluid was clear.

In this case the ovaries and tubes were as healthy as many women have who probably never have a symptom of pelvic trouble. I have removed much worse specimens after death, where there was no history of any symptoms referable to this pathological condition, yet no one who was well acquainted with the facts in this case, could have doubted the indications for this operation, judging entirely from the results.

I quote from a note received from this patient December 4, 1886: "I received your note this week, and am very happy to say I feel perfectly well. My head troubled me at first very much but it is constantly improving, and does not trouble me more than once a day (month?). I was unwell but twice, that being the two successive months after the operation. It took a long time to regain my strength, but I can say now that I never felt stronger or better. I have gained about twenty pounds."

CASE XIV. *Ovariectomy; recovery.*—Miss S., æt. twenty-six, for four months has noticed her abdomen increasing in size. The principal symptoms are due to inconvenience caused by the size of the mass.

Nov. 28. Dr. Thomas removed a twenty-two pound tumor of the right ovary. There had been suppuration in the cyst. The left ovary, which was enlarged and cystic, was removed with the tube. No complications. The patient made a good recovery.

CASE XV. *Removal of parovarian cyst; recovery.*—Miss R., æt. twenty-two. For four years her abdomen has steadily increased in size, most noticeably on the right side. The increase has been much more rapid for the past few months. Principal symptoms: nausea and shortness of breath. This patient came alone from Cuba. She was unable to speak a word of English, and I cannot refrain from a passing tribute to the courage that enabled her to come among strangers and undergo so serious an operation.

The patient had a severe chill after the operation, and her temperature ran up to 103° F. This readily responded to quinine; otherwise the case was uneventful.

CASE XVI. *Removal of ovarian cyst from right side, and of uterine appendages from the left; recovery.*—Mrs. H., æt. twenty-nine; no children, and no miscarriages. Well until one year ago, when her abdomen began to increase in size. The growth has been more rapid lately. It has seemed stationary for the past two months. Principal symptoms: inconvenience of locomotion and dyspnoea.

Dec. 5. Dr. Thomas removed an ovarian cyst from the right side. The pedicle was about eight inches in length and very thin. The left tube was enlarged and, with the ovary, bound down. From it stood out a gelatinous mass about as large as a thimble; this was broken in removing it. The ovary and the tube both removed. The temperature went up the first few days to 102.3° F., otherwise there was no complication. The patient was heard from nine months after the operation and was doing well.

CASE XVII. *Removal of uterine appendages; recovery.*—Mrs. B., æt. twenty-eight. Since the birth of her last child two years ago, she has

suffered very much at her periods and at other times. She has a marked ante flexion, but the uterus easily admits a large sized probe. She has been under treatment for two months in the hospital and for a long time outside of this institution.

Nov. 23. Dr. Thomas removed both ovaries and tubes. The tubes and ovaries on both sides were bound down by strong adhesions. The usual three layers of sutures used, but they were all of catgut. There were no complications. I heard from this patient a few months after the operation, but she felt no better, and thought she was somewhat worse.

CASE XVIII. *Removal of uterine appendages; recovery.*—Mrs. G., æt. twenty-two; no children; no miscarriages. This patient suffered for eleven years from dysmenorrhœa. She has been under treatment for more than two years. An ovary found prolapsed, and much inflammatory action about it. She has been in the hospital, and under observation for four months.

Jan. 2. Dr. Thomas made the usual incision, and found the tubes largely dilated and full of blood; these, with the ovaries, removed; she made a good recovery; no complications. I heard from her seven months after the operation; feeling very well, except for vesical irritability, which troubled her previous to the operation.

CASE XIX. *Removal of uterine appendages; recovery.*—Miss L., æt. twenty-three; has never menstruated; at periods of about twenty-eight days she has suffered from bearing-down pains. She was sent to the hospital for operation with the diagnosis of hæmatometra. It was ascertained that this diagnosis was incorrect, and it proved to be a case of undersized uterus and enlarged ovaries and tubes. She was sent away from the hospital, the dangers of the operation being strongly presented to her mind. In a few months she returned, saying she did not care to live and suffer as she was doing. She was a school-teacher.

Dec. 23. Dr. Thomas removed the tubes, which were dilated as large as small lemons, and full of clotted blood. The ovaries were the size of horse-chestnut burrs, and also filled with coagulated blood; they were also removed. There were no complications, and the patient made a good recovery. I heard from her some time since the operation, and she is doing well.

CASE XX. *Removal of ovarian cyst from left side, and of appendages from the right; recovery.*—Mrs. G., æt. twenty-eight; never pregnant. Her principal symptoms are, increase in size of the abdomen, which she has noticed for the past four months. She has also suffered from abdominal pain.

Jan. 16. Dr. Thomas removed an ovarian cyst of the left side. The right ovary was found cystic, and was also removed, with its tube. The operation was complicated by a band of tissue between the abdomen and the cyst. This was tied with silk, and divided. The highest temperature was 100.4° F. The patient left the hospital well. She has not been heard from since.

CASE XXI. *Removal of uterine appendages; recovery.*—Mrs. S., æt. twenty-seven; never pregnant; suffers from pain in her abdomen. Has had pelvic peritonitis several times.

Jan. 16. Dr. Thomas removed both ovaries and tubes. The left tube was much enlarged and filled with pus; both tube and ovary bound down by very strong adhesions. The tube was ruptured in removing it, and part of its contents escaped into the abdominal cavity. Right ovary and

tube firmly bound down. The tube was enlarged. The patient made a fair recovery from the operation.

Jan. 16, 1887. Mrs. S. writes: "I have felt very well, and have not needed any medical treatment."

CASE XXII. *Removal of uterine appendages; recovery.*—Mrs. M., æt. thirty-five; three children; the last child was still-born, three years ago; has had *grand mal* for three years. The periods between these attacks have grown less, and now appear every two weeks. Examination shows an enlarged and very tender ovary on the right side.

Jan. 23. Dr. Thomas removed ovaries and tubes. There were no complications, and the patient made a good recovery. She left the hospital in the middle of February.

THE STATION OF MAN, CONSIDERED PHYSIOLOGICALLY AND CLINICALLY.

BY GUY HINSDALE, M.D.,
OF PHILADELPHIA.

In forming an opinion of a man's physical condition it is desirable to observe not only his gait, but also his power of preserving an erect position while standing—which we technically call station. Even before any question may be asked, the physician can form an approximately correct opinion of the disease as the patient walks into his office, and stands before him.

For some time past Dr. Weir Mitchell's attention has been directed toward bringing to an arithmetical precision of statement certain symptoms which we are usually obliged to record with more vagueness of statement than is desirable. One of the most important of these inquiries has been as regards station. For this purpose, Dr. Mitchell suggested and used a simple form of apparatus, already described in a paper by Dr. Morris J. Lewis and himself. At this point, at his request, I took up this study.

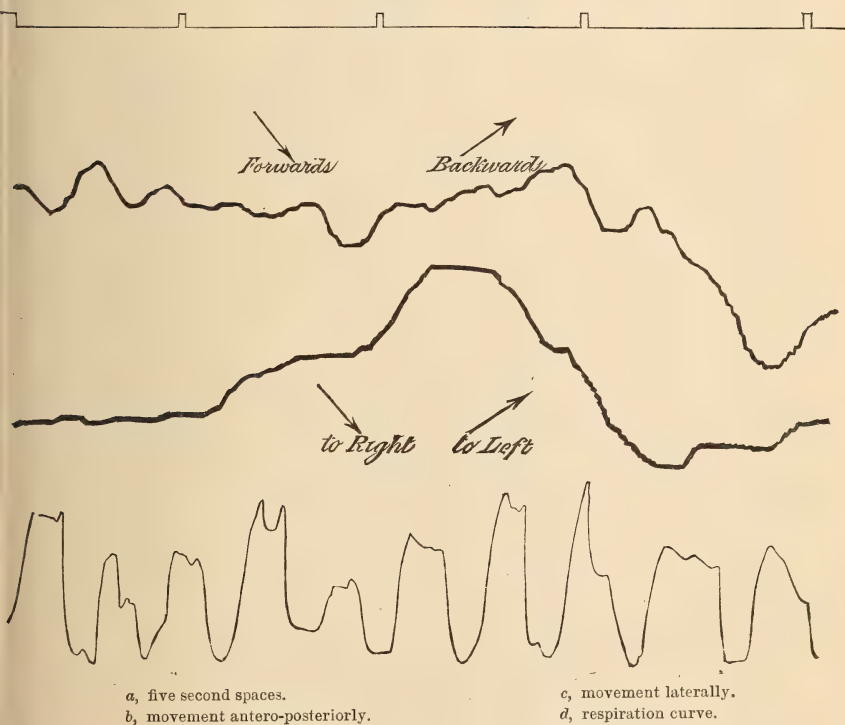
In order to do this accurately, it was necessary to construct certain apparatus so that the disturbances of equilibrium might be recorded. This was done with the assistance of Prof. Reichert, in the Physiological Laboratory of the University of Pennsylvania.

To observe the sway of a healthy man, the subject was made to stand with his heels and toes together; his hands were allowed to hang by the side; the head was held erect, the eyes being directed at a fixed object. A record of motions in the antero-posterior line was made by attaching a silk thread to a fillet over the forehead; the thread passed over a pulley, and was connected with a rod moving vertically, and carrying an index. This index marked a smoked paper attached to a

drum, which revolved laterally by means of clockwork. A downward movement of the index and a fall of the line scratched on the smoked paper, indicated a forward movement of the head; and an upward line recorded the backward movement.

In like manner the lateral movement was recorded. A silk thread was attached to the side of the head, and was carried at right angles to the forward and backward line, for a few feet, and thence by a pulley so as to move a needle and index at the side of the one recording antero-posterior movement, upon the same blackened surface. The sway for the two directions was thus resolved into upward and downward movements on the same paper. By means of a tube connecting the mouth

FIG. 1.

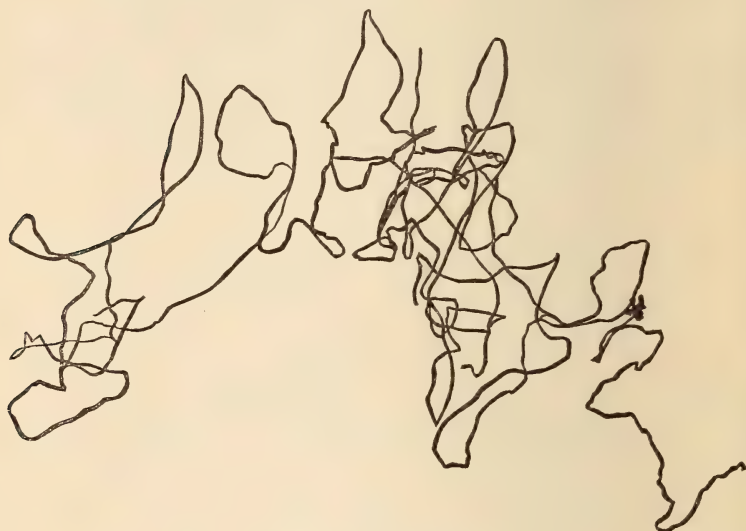


with a diaphragm which moved a lever and index, the respirations were also, in some instances, recorded. Seconds were marked on the paper by means of clockwork and an electric index. Such a tracing is shown in the accompanying engraving.

Other tracings were taken by attaching to the top of a man's head a flat piece of cardboard, upon which was stretched some smoked paper. The subject was then placed under an index, free to move up and down,

in a fixed line, and which traced curves on the paper as the subject who stood beneath swayed in any direction. This is the clinical method in practical use at the Infirmary for Nervous Diseases. A tracing from a case of locomotor ataxia is here shown.

FIG. 2.



Sway of a locomotor ataxic.

Other measurements were taken by placing the subject in front of a scale graduated in inches, and noticing the amount and direction of sway, the observer being seated about ten feet distant, and the head steadied; one eye being used in making the observation. When this has been done in front of the subject, the latter is then placed at a right angle to the first position, so that the antero-posterior sway may be recorded; or two observers may make these records simultaneously. The subject in no case is allowed to touch anything; the heels and toes are placed together, and he is not told the object of the inquiry.

This is the coarser method in practical use at Dr. Mitchell's clinic.

It was, of course, found that no man could stand absolutely still; the body swayed forward and backward, and from side to side, in every instance. The sway in the antero-posterior line was found to be greater, as a rule, than the lateral sway; the antero-posterior ranged in health from one-third to one and a half inches; the lateral sway from a quarter to an inch and a half. On closing the eyes, the sway was decidedly increased. This increase shows to how great an extent we use our eyes in correcting these oscillations. When we shut our eyes we cease, to a large degree, to correct these differences.

The first movement is almost invariably forward, then there is a counterbalancing effort, bringing the body backward, and usually to the right. The more pronounced sway is in the antero-posterior line, as may be seen in the tracings; as resultants of these, and of lateral sway, there are minor curves.

Clinically, certain abbreviations may be used in the records of cases, as follows: A. D. (antero-dextral). A. S. (antero-sinistral). P. D. (postero-dextral). P. S. (postero-sinistral). A. 1 D. $\frac{3}{4}$, would mean that the subject swayed forward one inch, and to the right three-fourths of an inch. This we have found to be the average for normal adults.

The records showed a law of irregular rhythmical motion. This was noticeable chiefly in the forward and backward movement, but these waves of motion did not correspond with respiration as a whole or fractionally.

Respirations per minute were recorded as follows: 21.5, 23, 20-21, 23, 31, 28, 29, 22, etc. In one observation, extending over three minutes, the subject, a healthy Irishman, employed in the physiological laboratory of the University of Pennsylvania, respired in the first minute 27 times, in the next minute 28 times, and in the third minute $26\frac{1}{2}$ times. The tracing, as usual, showed certain waves of antero-posterior motion; of these there were during each of the first three minutes, 12, 11, and 11 respectively. In another instance, in the same individual, the respiration was 22, and the antero-posterior waves 14. In the writer's case, 13 of these waves and 24 respirations were recorded in one minute. Thus the normal man has a rhythmical sway of about 14 to the minute. What governs this as to number is not clear.

A very large percentage of the normal individuals observed seemed inclined when losing their equilibrium to fall forward and then slightly to the right. The motion is greatest in the forward and backward line. The subject, as a rule, does not go so far backward as forward and not so far to the left as to the right.

We have endeavored to ascertain whether the sway to the right or to the left may be coincident with right-handedness or left-handedness. While right-handed people almost invariably are inclined to tilt over to the right, of 22 left-handed people 12 were inclined to tilt to the left.

This at once opens the whole subject of asymmetry. That the right side of the body, as a whole, is usually larger than the left, in persons who are right-handed, is generally accepted. The difference is noticeable in the shoulders and upper extremities. The right arm displaces several more cubic inches of water when immersed in a tube up to a given point, and is stronger than the left.

The weight of the arms being unequal the centre of gravity is, therefore, slightly on the right side; and it has been found that a man who has lost an arm sways to the sound side. "The weight of the arms is so

important in correcting the oscillations of the centre of gravity in walking, that if one be lost a runner needs another of the same weight."¹

The careful weighing of the muscles of the legs and of the back, excised from the body, has shown the right to be in excess.

The cause of this excess is doubtless finally to be referred to the central nervous system. The left cerebral hemisphere, from its slightly greater size, especially in the motor area, and greater density, has been termed the "leading side."

In connection with this it is interesting to state that Flechsig found the decussation of fibres in the anterior pyramid unsymmetrical, more crossing from the left brain to the right of the cord than in the opposite direction. It may, therefore, be that decussation of the motor fibres renders the right side of the body, from a muscular standpoint, the leading side. But Flechsig also found that nearly all the fibres decussated in some instances, forming the posterior column of the lateral opposite half of the spinal cord; however, in rare cases, almost none of the fibres decussated. It would be interesting to determine whether, in these cases, the subjects were or were not left-handed.

As an antithesis to this, M. Bourdon's observation is noteworthy. In the case of a man who forty years previously suffered a disarticulation of the *left arm*, the *right brain* showed a decided depression of the ascending frontal convolution, the paracentral lobule and the convexity of the right hemisphere; there was also enlargement of the right lateral ventricle, due to very extensive atrophy of adjacent white substance. The *right brain* weighed thirty-one grammes less than the left.²

The point I wish to make clear is that cerebral development and activity have a direct relation to muscular development and activity of the opposite side of the body. It would therefore not be irrational to suppose that, by educating the muscles of the left side until they were superior to those of the right, the right brain might then be made the leading side and the recognition of this might possibly give to those of delayed mental development a new centre for the cultivation of the powers of both mind and body.

In maintaining the erect position a large number of muscles of the body are in constant activity. Subjects must sway not only to the heavier side but also to the stronger side. The predominating muscles not only exercise this greater influence of their own, but there is probably added an increment of energy due to automatic tone waves created by the constant strain of other muscles in a state of tension.

This factor, combined with actual excess of tissue, produces in most persons an antero-dextral sway. The sinistral sway is found in a

¹ Hall and Hartwell, Johns Hopkins Univ., "Mind," No. xxxiii.

² Revue de Thérapeutique, Méd.-Chir., No. 11.

majority of left-handed people. It is found rarely in those who are right-handed.

Twelve individuals, mostly young men in good health, were carefully observed, tracings of the sway being recorded on the drum. There was, with the eyes open, a maximum antero-posterior sway of 1.56 inches and a minimum of 0.32 inch, the average being one inch. Laterally the average was 0.78 inch, the maximum being 1.50 inches, and the minimum 0.24 inch.

With the eyes closed these figures were considerably increased. The averages for forward and back and for lateral sway were increased 80 per cent. and 28 per cent. respectively, making 1.8 inch for antero-posterior, and 1 inch for lateral sway. These figures may be considered normal for young men in health.

Allowing the eyes to wander about the room, though the head be not turned—in other words, the absence of fixation of the eyes, reading aloud, and removal of the shoes and stockings, increase the bodily sway. In one instance the lateral sway of a man was one-fourth of an inch. Removal of the shoes and stockings increased this to $1\frac{1}{4}$ inches. The antero-posterior sway in the same instance was 1.52 inches, but after removal of shoes 2.88 inches—almost double. Comparisons made with eyes shut, with shoes and without shoes, showed a corresponding increment. In the writer's case this increment was 16 per cent. for antero-posterior and 12 per cent. for lateral sway. In a number of observations the increase of sway varied considerably; no changes were observed excepting that of extent of the oscillation.

Twenty-five girls, between the ages of seven and thirteen, were examined in orphanages. The lateral sway averaged 1.06 inches, the antero-posterior sway 1.08 inches. Shutting the eyes increased this sway about 40 per cent.

Eleven boys yielded slightly greater figures than in the case of girls—an increase of 7 per cent. for lateral sway, and 13 per cent. for antero-posterior sway.

Children sway absolutely more than adults, and there is a greater equality in their cases between the antero-posterior and the lateral sway.

Thirty-nine inmates of the Institution for the Blind were examined, by permission of Dr. Harlan. The average lateral deviation was found to be 1.4 inches; the antero-posterior deviation 1.7 inches. This is about the normal sway of healthy individuals with their eyes shut, and shows that the blind, even after years of experience, are not able to preserve their equilibrium better than the man who is momentarily deprived of eyesight.

Seventeen deaf-mutes, between fourteen and twenty-four years of age, were examined at the Institution for the Deaf and Dumb, by permission of Dr. Wharton. The average lateral sway was found to be 0.93 inch,

and the average antero-posterior sway 0.85 inch. With the eyes shut the sway increased so that the average for lateral sway became 1.18 inches, an increment of 27 per cent., and the antero-posterior sway 1.31 inches, an increment of 54 per cent. It may be said of these figures that the boys are trained in military practice, and that their shoes are stout and have broad soles. They were all right-handed; they all swayed to the right excepting two, one of whom swayed to the left, the other swayed to both right and left.

Opportunity was taken at this time to test the liability of deaf-mutes to become dizzy. It was discovered by Prof. William James, of Harvard University,¹ that deaf-mutes, in whom the semicircular canals are frequently diseased or destroyed, are not so likely as others to lose their equilibrium or to become dizzy. Three boys were turned rapidly about while standing on their feet; they were then told to walk rapidly down a line on the floor. Although they were turned a dozen or more times, they were all able to walk a straight line without wavering. A fourth confessed he was very dizzy, and diverged widely from the line. The three who were first tested were far better able to keep the line than was the writer.

The influence of ether on station was also observed, with the aid of Dr. W. C. Lott. Tracings from both of us were obtained. We took the ether in the standing position so that the index of the apparatus could write at any desired moment. As the ether was taken the writer seemed to be pivoted as a top when nearly done spinning, and finally it seemed as though the feet were not resting upon any solid foundation. The tracings, apparently, do not show anything more than a great exaggeration of the normal sway.

In several cases of locomotor ataxia the sway with the eyes open was observed to vary from 2.25 inches to 3.75 inches in the antero-posterior line, one from 2.50 inches to 3.25 inches laterally. One of these has been engraved. Six observations with the eyes shut showed a lateral sway of 3 to 6 inches, and antero-posteriorly 3 to 7 inches. An interesting tracing of a case of spastic paralysis showed that the oscillations were almost wholly in the antero-posterior line. Ten tracings from cases of chorea were taken. With the eyes open, the lateral deviation averaged 1.45 inches; the antero-posterior deviation, 2.35 inches. The sway slightly increased when the eyes were shut.

As a result of these observations there arise certain valuable formulæ which point to further physiological research and have direct clinical utility.

They show that the normal man and woman have an average sway of

¹ The Sense of Dizziness in Deaf-Mutes. By Wm. James, M.D. Amer. Journ. Otology, Oct. 1882.

about one inch in the forward and back line, and three-quarters of an inch laterally.

That children sway to a slightly greater extent than adults, and that, both in adults and in children, closing the eyes increases the sway about 50 per cent.

An artificial agent, such as ether, simply exaggerates the normal sway.

That a law of rhythmical motion governs the sway of man. The cause of this is not yet clear.

The methods introduced by Dr. Mitchell for studies of this kind enable clinical inquirers to make accurate statements which may be comparable with the observations of others.

EXCISION OF THE ENTIRE CLAVICLE FOR CENTRAL CARCINOMA.

BY JOHN SLOAN, M.D.,
OF NEW ALBANY, INDIANA.

JAMES F. M., of Washington Co., Indiana, came to my office November 21, 1885, with his physician, Dr. Maxedon, to consult me in relation to an enlargement of his right clavicle. He was fourteen years old, large and robust. Had had pain in the bone since May; observed an enlargement October 15th, and consulted his physician. It had grown rapidly, extending upward and inward, the greater enlargement about two and a half inches from the sternum. I advised its immediate removal.

He returned November 28th, accompanied by Dr. M. and two other physicians of his town, who, with several others of this city, assisted in the operation. On examining the mobility of the shoulder, before placing him on the table, I fractured the bone, which made the operation more protracted. He took chloroform kindly. An incision was made from the centre of the sternum to a little beyond the acromial extremity of the bone; the parts were dissected from the anterior surface; it was disarticulated from the scapula, a noose of cord placed around it for traction; and it was carefully separated from its connections with probe-pointed scissors and scalpel to the place of fracture. The sternal fragment was seized with forceps, disarticulated from the sternum, and carefully dissected out. Arteries as divided were seized and held by compressors. Capillary hemorrhage was arrested by hot sponges.

The time occupied in the removal was forty-five minutes. Three small tents of twisted marine lint were placed in the wound for drainage, it was closed with wire sutures, dressed with a compress of marine lint

and bandage. No vessels required ligation. The drainage tents were removed on the second day; there was moderate suppuration from two places. The sutures were removed on the seventh day; union was complete at the extremities, and a portion of the centre.

On January 13th he returned home, thirty miles, by stage. The wound was healed, except two small points which had scabbed over. Dr. Maxedon remained with and cared for him the first ten days. His highest temperature was $101\frac{1}{2}^{\circ}$, on the second day; afterward normal. Morphine was given for a few nights to procure sleep, and an occasional laxative.

The circumference of the bone, three inches from the sternal articulation, was five and a half inches. On section it presented a thin shell of bone exteriorly with calcareous infiltration throughout the interior; I dissolved the bony and calcareous material in dilute hydrochloric acid, made some sections, stained them in picro-carmin, and mounted them in glycerine. They showed a dense stroma of connective tissue, with some spindle cells, and large nests of cancer cells. He visited me about the 5th of April; there was evidence of the return of the cancer in the line of the cicatrix, and in the glands of the neck.

REVIEWS.

RECENT WORKS ON OPHTHALMOLOGY.

THE REFRACTION AND ACCOMMODATION OF THE EYE, AND THEIR ANOMALIES. By E. LANDOLT, M.D. Translated by C. M. CULVER, M.D. Edinburgh: Young J. Pentland, 1886.

THE HYGIENE OF THE EYE IN SCHOOLS. By HERMAN COHN, M.D. Translated by W. P. TURNBULL. London: Simpkin, Marshall & Co., 1886.

THE DIRECTION OF THE LYMPH-STREAMS IN THE EYE. By H. GIFFORD, M.D. *Archives of Ophthalmology*, June, 1886. New York: Putnam & Sons.

A CONTRIBUTION TO THE STUDY OF SYMPATHETIC OPHTHALMITIS. *Archives of Ophthalmology*, Sept. 1886.

REPORT OF THE COMMITTEE ON SYMPATHETIC OPHTHALMITIS. *Transactions of the Ophthalmological Society of the United Kingdom*, vol. vi. 1886. London: J. & A. Churchill.

ON A CASE OF MENINGITIS FOLLOWING EXCISION OF THE EYEBALL. By E. NETTLESHIP. *Archives of Ophthalmology*, September, 1886.

EITRIGE MENINGITIS NACH ENUCLEATION. By R. DEUTSCHMANN. *Archiv für Ophthalmologie*, xxxi. iv. p. 251.

L'ANTISEPSIE COMME MOYEN PRÉVENTIF DES DANGERS DE MORT APRÈS LES OPERATIONS ORBITAIRES. By L. DE WECKER. *Annal. d'Oculist.*, Jan., Feb., 1886.

TRAITÉ COMPLET D'OPHTHALMOLOGIE. Par L. DE WECKER and E. LANDOLT. Tome III. fasc. 3e. Paris: 1887.

SUBJECTIVE SYMPTOMS IN EYE DISEASES. By G. BERRY, M.D. Edinburgh: Oliver & Boyd, 1886.

THE CAUSES AND PREVENTION OF BLINDNESS. By DR. ERNEST FUCHS. Translated by DR. R. E. DUDGEON. London: Ballière, Tyndall & Cox, 1885.

DISEASES OF THE EYE. By DR. FERDINAND VON ARLT. Translated by S. WARE, M.D. Edinburgh: Young J. Pentland, 1886.

Our object in the following pages is not so much critically to review the works enumerated above as to consider in what direction the science and practice of ophthalmology are likely to be affected by them; we shall therefore have little to say concerning their defects and omissions, but shall deal almost entirely with their positive aspect.

The estimation of correction of errors of refraction forms so large a

portion of ophthalmic practice that no apology is needed for dealing first with works on this and allied subjects.

There can be no question that Dr. Landolt's work will, for many years, be the standard authority on refraction. The scientific study of this branch of ophthalmology may be said to date from the publication of Donders's *Anomalies of Refraction and Accommodation*, and Helmholtz's *Physiologische Optik*. Since then, no original work of importance has appeared, and although many minor treatises have been written, these have dealt almost exclusively with the means of diagnosing the more common abnormalities, and have made no attempt to treat the subject exhaustively. Since 1860, however (the date at which Donders's book appeared), very great changes have been introduced. The use of the ophthalmoscope has become more general, and its construction immensely improved, the refraction instruments which a few years ago were expensive instruments, only possessed by a few, are now the rule, and, as a consequence, great importance is attached to all objective tests. The introduction of the metrical system and its adaptation to the measurement of convergence have much simplified calculations. At the same time an enormous amount of information, statistical and otherwise, has been collected on the subject of myopia and the causes of its increase. All these facts point to the want of a standard work which shall serve as a fresh starting-point. This is to a great extent supplied by the book before us.

Of the physical portion there is not much to be said, since most of the facts are now common property. The mathematical elements are less prominent than in Donders, while an abundance of excellent illustrations saves much verbal explanation. The optical constants adopted are those of Helmholtz, and this portion of the book will be extremely useful for reference.

Our chief interest here, however, is with the clinical portion. The author's optical treatment of ametropia differs considerably from that adopted generally. In hypermetropia he makes no attempt to correct the whole or even nearly the whole of the defect, but encourages the patient, even in distant vision, to use two-thirds of his total accommodation. For instance, a patient with hypermetropia of 5 D., whose amplitude of accommodation was 3 D., would still be permitted to use two dioptries of an accommodation, and would therefore be ordered + 3 D. The correction for near vision is calculated in the same way. It appears to us that the plan ordinarily adopted of correcting the whole of the manifest hypermetropia and a constant fraction of the latent, is more sound theoretically, and practically as satisfactory. Dr. Landolt's plan, indeed, appears to aim at correcting as little of the hypermetropia as may be, while the aim of the other is to correct the defect as nearly as possible, and thus coax the patient to relax his accommodation.

The optical treatment of myopia has always been a matter on which there was some diversity of practice. On this subject Dr. Landolt has no hesitation, but emphasizes the following rule by printing it in small capitals, "A myope must be prohibited from wearing concave glasses for any distance at which he can see without accommodating." In other words, a myope of 3 D. must be forbidden to wear his correcting glass when looking at objects at 33 cm. (13 inches) or nearer. This would, we believe, entail considerable inconvenience upon many patients without any corresponding advantage. For years past it has been the prac-

tice in England to allow myopes of moderate degree to wear their full correction for all purposes, except when the disease is progressing, and no harm has been found to result.

The author's well-known interest in all that relates to the ocular muscles gives to his remarks on this subject an authoritative character. This part should be read in connection with the chapter on the same subject in the *Traité complet*. We are at present probably only on the threshold of this subject, and much remains to be done. This portion of the book, however, forms an able *résumé* of our present knowledge, for much of which we are indebted to Prof. Landolt himself.

Donders's statements as to the relations which exist between convergence and accommodation still hold good, and the adaptation of the metrical system has rendered it more easy of demonstration. Nearly all the facts, however, as to the relative amount of convergence and divergence possible to different individuals are more modern. The rules for guidance in the adoption of operative or other treatment are laid down upon a logical basis. The position of parallelism of the visual axes is denoted by zero, and divergence and convergence are expressed in metrical angles with the sign — or + prefixed. The normal standard taken is an amplitude of convergence of ten metrical angles (m. a.), of which one is negative and nine positive. This may be departed from in many ways. The range of convergence may be normal, but the whole may be carried too far to the negative or positive side, or the amplitude may be curtailed at either or both extremities. Whenever the positive convergence fails there is asthenopia in near vision. Convergence is measured by means of Landolt's ophthalmo-dynamometer and divergence by prisms. Tenotomy of the abductors diminishes the negative portion of the range, and increases the positive at least to the same extent, and usually, if the adductors are sound, to a greater extent. It is, of course, only available when part of the range is negative, or actual convergence would be produced. When the internal recti are weak, as shown by shortening of the positive range, it does little good and one or both internal recti must be advanced. If the external recti are weak tenotomy of the internal may be performed also. When the amplitude of accommodation is much below normal the case is not well adapted for operative interference.

A work of a totally different character, yet dealing with very kindred subjects, is Cohn's *Hygiene of the Eye in Schools*. It is not, indeed, a new work, but until the appearance of this translation it was not very familiar to English readers. If some such book were used as a text-book for all engaged in teaching we should see less of the evil effects produced during school-life from ignorance of the capabilities of the growing eye. Its appearance is especially opportune just now, when there has been a tendency shown to minimize the evils of myopia, and to regard it in some quarters simply as a physiological adaptation of the eye to the requirements of civilized life. After an introductory portion adapted for the laity, we come to the real pith of the book—a description of the faulty positions assumed by school-children, and the defects of school desks, bad illumination, and faulty type, which necessitate or facilitate such positions.

The main interest of the book from a medical point of view, however, centres round the oft-quoted statistics. These should be read in conjunc-

tion with Dr. Randall's comprehensive paper "Refraction Statistics," *American Journal of the Medical Sciences*, 1885. These prove conclusively that the number of cases of myopia and its degree progressively increase from the lower to the higher classes of schools, and are greater in the higher than in the more elementary schools, in which the average age of the scholars is the same.

Of late years the views prevalent regarding refraction have been greatly modified. It may now be considered established that hypermetropia is the normal condition at birth, and that emmetropia is seldom reached till the age of six or eight, that after this age a considerable proportion of children become myopic.

Much more valuable, in our opinion, than these colossal statistics are those, more limited in number, which show the changes undergone by individual eyes in a certain number of years.

It was long believed that hypermetropia was a stationary condition, and that the cases of myopia were derived from eyes which were originally emmetropic. No less an authority than Donders has expressed the opinion that hypermetropic eyes did not become myopic. If, however, all eyes are originally hypermetropic it is evident that this view must be abandoned; indeed, the statistics just referred to seem to show that a very considerable number of children who are still hypermetropic at the commencement of school-life eventually become myopic. Nor is it possible any longer to maintain that sharp distinction between progressive and stationary myopia which has, until lately, been customary, for there are numerous statistics which show that myopia nearly always continues to increase to some extent during the whole of school-life. Of course, there is marked and most important difference between a myopia which ceases to increase at puberty, or thereabouts, and is unaccompanied by atrophic changes in the choroid, and that form of it which continues to increase throughout life, and is accompanied by atrophic changes in the region of the posterior pole. Landolt and others name the first typical myopia, and the second atypic or malignant.

Of the statistics showing changes taking place in the same individuals we quote those of Erisman and Reich,¹ as in each the interval was as long as six years (the latter are not given by Cohn). Erisman found 23 per cent. and Reich 25 per cent. only whose refraction had not increased. Of cases of hypermetropia which had passed into myopia Erisman found 13 per cent., while the proportion of emmetropes who had become myopic was only slightly greater, namely 16 per cent. Reich's figures are much higher, but the relative proportion is nearly the same. Now when it is considered that the slightest increase in the refraction of an emmetropic eye renders it myopic, while the hypermetropic has first to become emmetropic, it is apparent that the eye which remains hypermetropic beyond the normal period, is one which, under the influence of school-life, is very liable to become myopic. There are statistics to determine whether myopia thus produced is of a rapidly progressive character.

The last volume of the *Transactions of the Ophthalmological Society*, though containing much that is of interest, will contribute most to the permanent advance of ophthalmology through the comprehensive report

¹ Arch. für Ophthal., xxxi.

of the Committee on Sympathetic Ophthalmitis, and Mr. Nettleship's paper on "Meningitis following Enucleation."

In connection with the former we take Gifford's important papers, which have certainly thrown new light upon the pathology of sympathetic inflammation. The author states that his experiments were originally undertaken with the intention, and in the expectation, of confirming Deutschmann's results. To make the significance of Gifford's results apparent it will be necessary briefly to glance at the position to which Deutschmann's¹ experiments had brought our knowledge of the pathology of this affection. Injecting pyogenic micrococci into the vitreous of one eye in rabbits, he had almost always succeeded in producing papillitis in the other, which persisted till the death of the animal, which always occurred within a few weeks. On examining the parts, the microorganisms were found in abundance in the intersheath spaces of both optic nerves, in greater quantity as the globes were approached, and around the chiasma. When the infecting material was introduced into the optic nerve which had been ligatured on the proximal side, inflammation of the uveal tract was set up, from which it was concluded that the immunity enjoyed by this in the other experiments was due to the early death of the animal. In order to test the applicability of these experiments to sympathetic ophthalmitis as it occurs in man, culture experiments were made with aqueous, and portions of iris removed during life from the sympathizing eye. The microorganisms thus reared appeared to possess all the properties of those inoculated in the original experiments, and they produced the same effect when injected into the rabbit's eye. The existence of microphytes in the exciting eye having been previously proved, the chain of evidence as to these being the cause of the inflammation of the second eye seemed fairly complete, and it was not unnaturally concluded that the microphytes had travelled from the first eye to the second along the optic nerve sheaths and chiasma. Their passage might indeed be considered proved, but as regards their mode of transit there were at least two weak points in the evidence. In the first place, it is necessary to assume that in one nerve they travelled against the lymph stream. Secondly, why should they be more redundant near the globes? An obstruction at the papilla of the second eye would explain their accumulation behind it, but why should there be a similar condition in the nerve of the first eye? Gifford's experiments throw light upon both these points. In his first paper he cleared the ground by showing the direction of the normal lymph currents between the eyes and the brain. In numerous experiments injections of colored substances were made into the vitreous with the following results:

"When a small drop of sterilized water, containing Indian ink or cinnabar in suspension, is introduced there is generally little or no reaction. The next day, or later, if the injection is made far forward, one sees with the ophthalmoscope the particles collecting in the optic excavation; if the animal be killed a day or two later, the central canal is marked by a black or red line which leaves the nerve with the vessels, and can be traced a short distance toward the apex of the orbit. Microscopically one sees that the granules are contained in the perivascular lymph spaces. They can also be traced along the small vessels given off to the papilla, nerve, and choroid. None were found in the intervaginal or dural sheath. . . . Anthrax bacilli followed the same course, but did not enter the finest canals. As they multiply where-

¹ Archiv für Ophthalmologie, xxx. iii.; xxvii. ii.; xxix. iv. etc.

ever they are carried, they are found in considerable number in the orbit, and if the animal lives long enough, in the cranial cavity."

These experiments clearly demonstrate the existence of a lymph current from the vitreous to the brain along the bloodvessels.

Gifford then repeated Quincke's¹ experiments of injecting cinnabar into the cerebral subdural space after trephining, and found that it travelled down the intervaginal space of each optic nerve, being more abundant near the globes. The fact that the suprachoroid can be readily injected from the intervaginal space perhaps answers one obvious objection to the bacterial theory of sympathetic inflammation—namely, that the chief stress of the affection is not upon the optic papilla and retina, but upon the uveal tract.

Gifford's second paper has a more immediate bearing upon pathology. His experiments with the same microorganisms as were used by Deutschmann led to very different results; the animals did not die, there was no permanent effect produced on the other eye, and, although there was inflammatory exudation into the sheaths of the nerve for some distance behind the eye, in no instance did the micrococci themselves extend beyond the lamina cribrosa.

We do not propose to discuss the several explanations which might be given of these experiments, giving different results to those of Deutschmann, but pass to Gifford's experiments with the anthrax bacillus. One difficulty with this bacillus is, that if the subconjunctival tissue is inoculated the animal dies. It was exceedingly difficult to prevent this, hence the negative result as regards affection of the second eye of the majority of the experiments. The three cases, however, in which this was affected are extremely instructive. In each the bacilli could be traced along the vessels to the apex of the orbit; they were present in the cranium around the chiasma; they were to be traced *down* the intervaginal space of each nerve, increasing in quantity near the eyes.

It is manifest that these experiments are too few to establish any theory upon. Still, taken in conjunction with those bearing on the course of the lymph-currents, they are significant. While strengthening the theory that migration of microorganisms is the exciting cause of sympathetic ophthalmitis, they render it extremely doubtful whether the optic nerves can be considered as the direct channel of communication. If the mode of infection suggested by these experiments should be confirmed by others, several difficulties, which have hitherto stood in the way of accepting the bacterial theory, will be removed, and if there is really this double road by which the bacilli can travel, it is not at all impossible that a relapse of inflammation in a sympathizing eye may react upon the exciting eye, a possibility in favor of which there is some clinical evidence.

The report of the Committee of the Ophthalmological Society on "Sympathetic Ophthalmitis" is of a different nature from the papers just quoted, the evidence being entirely clinical. The report is based upon 200 cases collected from various sources. Of these, fifty ended in complete recovery, and a very considerable number had useful vision. Obviously, however, this does not give the real percentage of recoveries, as there would be a much greater tendency to publish the successful cases. The same difficulty, though to a less extent, arises in estimating

¹ Reichert's and Du Bois Reymond's Archives, 1872.

the effect of various modes of treatment. The Committee have rightly been chary of drawing conclusions, and have merely arranged the facts bearing on the different points. Some conclusions do seem, however, fairly deducible. We should say that Mauthner's view that enucleation of the exciting eye aggravates a mild attack of sympathetic inflammation, if not disproved, is, at any rate, rendered extremely improbable.

One of the points on which the Committee endeavored to collect evidence was as to the possibility of sympathetic ophthalmitis occurring without a perforating lesion of the exciting eye. Considering the very wide field over which the evidence was sought, it is impossible to avoid the conclusion that had this been possible unequivocal examples would have been found. Of course, it is necessary to exclude at the outset all cases in which the first eye suffered from spontaneous irido-cyclitis from a constituted cause, for in such it is impossible to exclude the action of the same cause upon the second eye. The only cases admissible would be those of injuries without perforation, or of affections which are dissimilar to sympathetic iritis (for a constitutional cause would not produce different symptoms in the two eyes). Since, however, spontaneous uveitis may occur in the second eye, it is evident that cases must be accepted with great doubt in which the affections of this eye did not appear until long after the usual interval which separates the affection of the two eyes in true sympathetic ophthalmitis. Now of the eight cases which have been selected as the only ones approximately fulfilling the conditions, in two there was an interval of sixteen and twenty years respectively, while in the remainder the evidence of no perforation having occurred was far from being conclusive. Genuine cases, had they occurred, would certainly have been published and the absence of such is strong evidence of their non-existence. It is evident that this strengthens the view of the septic nature of sympathetic inflammation.

The series of cases in which the symptoms did not appear in the second eye until after removal of the injured eye is of great interest. The general mildness of these cases seems clearly to point to enucleation being likely to influence the course of sympathetic inflammation favorably. There are numerous other points on which the evidence is very suggestive, but for these we must refer to the report itself.

That meningitis which is generally fatal occasionally results from enucleation has long been known. The cases, however, that had occurred were scattered throughout medical literature, and it was difficult to estimate the frequency of the complication or to arrive at definite conclusions as to its pathology. In the papers of Nettleship, Deutschmann, and de Wecker attempt has been made to collect all the published cases, and although these probably represent but a proportion of those that have actually occurred, much can be learnt from their comparison. Perhaps a better idea of the percentage of the enucleations that are followed by meningitis can be formed by taking the percentage of individual operators. Thus de Wecker and Alfred Gräfe, *Exenteration ver Enucleation Bulbi*, 1884, give an almost identical percentage—namely, 0.3 per cent.

Deutschmann's paper gives an account of twenty-six cases, de Wecker of one that is not included in this, Nettleship gives one of his own, and six others not previously published. We have thus a total of thirty-four cases; it would be well, however, to exclude one of Deutschmann's in which the operation was complicated by the removal of a malignant tumor from the orbit, and one of MacHardy's, in Mr. Nettleship's paper,

in which the eye was not enucleated, but torn out by the patient himself.

De Wecker's case is not free from doubt, since there is no record of the temperature, and the patient died at home. No post-mortem examination was made.

Several important questions arise in connection with these cases. In the first place, the uniformity of the interval that separates the operation and the commencement of the symptoms leaves no doubt that the meningitis was really caused by the operation. Thus, in twenty cases in which the interval is given, it was twenty-four hours or less in eleven, between twenty-four and forty-eight in five, and over forty-eight in only four (Nettleship). Whether the condition of the enucleated eye has any share in causing the meningitis is a question that has been much discussed, but which cannot at present be determined. The condition is mentioned in twenty-seven instances, in fourteen of these suppurative panophthalmitis was or had been present. Long ago von Gräfe laid down the dictum that an eye should not be excised when in a state of active suppuration, and, as there are no data to show to what extent this rule has been followed, it is impossible to say what value can be attached to the above figures. It is curious that of the five cases which recovered after developing symptoms of meningitis, four were cases in which there had been no suppuration.

In all the cases except four there had been a perforating lesion of the enucleated eye, and, therefore, the possibility of septic inflammation. De Wecker attributes considerable importance to inoculation of the orbital tissues with the contents of the globe at the time of the operation. As a matter of fact, rupture of the globe did occur in a considerable proportion of the cases, and inoculation could easily occur in those in which the wound was recent or unhealed.

The post-mortem appearances were extremely variable, the meningitis was of a purulent character in nearly all, generally affecting the convexity of the brain as well as the base, and in some instances being even more marked in the former situation. Although the sheaths of the optic nerve offer the most obvious channels for the transmission of the inflammation, changes were found in only three instances, while in six others the most minute microscopical examination failed to discover any abnormal condition in the nerve sheaths. The cellular tissue of the orbit appeared to be normal in nearly all the cases. The implication of the convexity leads Nettleship to think that the veins form the channel of communication, which might be the case without there being obvious changes in them. In view of Gifford's investigations as to the course of the lymph stream from the eye to the brain, infection travelling along the central vessels of the optic nerve is by no means impossible. There are, probably, however, several channels by which the inflammation may travel, and it is possible that the same are not always implicated.

This subject, of meningitis following enucleation, has an especial importance at the present time because attempts have recently been made to introduce substitutes for the operation. Both in Deutschmann's and de Wecker's papers it is contended that exenteration is safer in this particular respect. We do not propose to enter here on a discussion of the relative advantages and disadvantages of these two operations. It is obvious that their relative safety in regard to a complication which occurs only three times in a thousand operations can at present only be

discussed on theoretical grounds. If the meningitis is in any way dependent upon inoculation with the contents of the eye, then it surely must be safer to remove these enclosed in a dense covering of normal tissue, as is done in enucleation, than to make an incision into the inflamed cavity and remove piecemeal as much of the contents as possible as is done in exenteration. In this latter proceeding inoculation of the conjunctival wound cannot be avoided, and it is impossible to follow microörganisms into crevices formed by irregularity of tissues, or the orifices of vessels. If, on the other hand, it is assumed that the meningitis results from infection of the wound at some period subsequent to the operation, this ought to be obviated by using strict antiseptic precautions. Practically the choice between exenteration and enucleation will be decided on totally different grounds.

If we were asked in what respect ophthalmology has recently contributed most to the advancement of medical science, we should point to the aid that it has afforded to the localization of cerebral affections. The present position of science in relation to this important subject is well delineated in a most able and exhaustive article by J. P. Nuel in the last volume of the *Traité Complet*. In conjunction with this might be read Dr. Berry's little book, which, although in many instances merely touching the surface of the subjects treated of, yet forms a valuable contribution to the medical aspect of ophthalmology.

As showing how recent has been the advance of our knowledge in this respect we may remind the reader that it is only quite in recent years that the question of partial or total decussation of the optic nerve was keenly discussed, whereas now, not only is it universally admitted that the fibres of the right halves of the two retinae go to the right optic tract, and *vice versa*, but much progress has been made in tracing them to their ultimate destination.

In regard to the latter there is, however, still considerable difference of opinion. According to Charcot, all the fibres which do not decussate at the chiasma do so a little behind the corpora geniculata. According to this view, lesion of one hemisphere behind this point would produce total blindness of the opposite eye. This scheme has, however, not been generally adopted, and the clinical evidence appears to be against it. Nuel seems to ignore Charcot's theory, does not discuss the probability of there being any decussation behind the chiasma, and considers the whole matter settled by the following rather bold assertion, "numerous examples of homonymous hemianopia (*i. e.*, loss of the right or left halves of both visual fields) from lesion of the opposite hemisphere, especially of the cortex of the occipital lobe, prove that all the fibres of one optic tract go to the hemisphere of the same side." It is evident, however, that this assertion is too sweeping, since Ferrier (*The Functions of the Brain*, 1886) gives sufficient experimental and pathological evidence to show that sometimes the blindness thus produced is only temporary, and that in several experiments the lesion of the whole of one occipital lobe, and even of both, has not been followed by any impairment of vision. On the other hand, destruction of one angular gyrus produces total blindness of the opposite eye and not hemianopia. The only scheme which at present appears consistent with all the facts is that proposed by Ferrier, namely, that each occipital lobe, in virtue of the semidecussation at the chiasma, is in relation with the corresponding half of each retina, but

that each angular gyrus is in relation with the fovea centralis of the opposite eye only, some of the fibres decussating near the corpora geniculata, and others at the chiasma.

Nuel lays down very clearly the character of hemianopia from cerebral lesions, the sharp limitation and symmetry of the scotomata being important features. The loss of activity by the pupil, when the lesion implicates the optic tract, and its retention when it is in the occipital lobe, are also pointed out.

Both this author and Berry mention the fact that in hemianopia from lesions of the tract, the optic disk of the eye of the side opposite to the lesions shows signs of atrophy before the other; this is explained by the fact that the direct fibres are covered by the crossed ones.

In Dr. Berry's book are some valuable hints as to the significance of the impairment of the light-sense; this is a subject which has been allowed to fall very much into oblivion; yet it may sometimes afford valuable indications—for instance, when there is considerable opacity of the vitreous, the fact that the light-sense was not much impaired would, it is said, exclude the existence of the detachment of the retina. In glaucoma simplex there is great diminution of vision with feeble illumination, and but little difficulty in distinguishing between different degrees of intensity in the light, whereas in optic atrophy these conditions are reversed. There is, however, much practical difficulty in applying subjective tests of this nature to patients of only average intelligence.

Dr. Berry discusses the somewhat difficult subject of the vision of those who are color-blind very clearly, and ably supports Hering's theory that color vision depends upon the existence in the retina of three substances, each of which is acted upon in two ways by opposed (or complementary) colors, and that defects in color-vision depend upon the absence of inertness of one of these. This theory necessitates the view that color-blindness cannot exist for one color, but must concern a pair of complementary colors. Perhaps the best proof that this is really the case is furnished by Masson's disk; the colors are so arranged that the sensation of gray is produced in the normal eye when the disk is rotated; amongst the colors are placed two which are complementary. If both these are removed, the effect of gray is preserved, while if only one is removed a sensation of color is produced. Now to the color-blind also the first mixture appears gray; if, however, only one color in it failed to affect the sensorium, the remainder should give rise to a color impression. If, however, we admit that defect for one color necessitates also a defect for its complement, that does not altogether disprove the Young-Helmholtz theory, though it certainly weakens it.

Professor Fuchs's essay on the "Causes and Prevention of Blindness" is a valuable contribution to ophthalmic literature, since it brings to a focus our scattered knowledge upon a variety of subjects, and presents it as a vivid picture. It touches on many points which are of importance to several sections of the community. The chapter devoted to the effect of school-life upon the eyes well deserves the serious attention of all who have to do with school construction or management. The ground is much the same as that covered by Cohn's *Hygiene* already referred to, but the enormous difference in the demands made upon the school children of Germany and England is well brought out, a difference which has its fruit in the great prevalence of myopia in the former. The plan

of lighting by the electric light that is recommended, is to have a very bright light hung from the centre of the room, beneath this a concave mirror which conceals it from view, and throws the light on to the white ceiling from which it is reflected to all parts of the room. Probably this, when the conditions are properly observed, would give the nearest approach to diffuse daylight that could be obtained.

We propose, however, to confine our attention to the medical points of interest. In the chapter on congenital and hereditary affections, the question of the influence of consanguinity of the parents on the occurrence of retinitis pigmentosa in the offspring is discussed with more impartiality than has previously been the case. Many previous statistics have been vitiated by the circumstance that they have been compiled from exceptional sources—for instance, the inmates of asylums for deaf-mutes; but a large proportion of these are known to be the offspring of consanguineous marriages. Taking 147 cases of retinitis pigmentosa collected from various ophthalmic clinics, 34 per cent. were found to be the offspring of consanguineous marriages. Now the proportion of these marriages (in France) to all marriages is only about 1 per cent. There is, of course, the obvious objection that the cases of retinitis were collected from several countries, and the statistics of marriages from France, but the disproportion is too great to be explained thus.

In dealing with contagious affections of the conjunctiva, Fuchs adopts the classification of Arlt, which has not generally been followed, though there is much to be said in its favor. Blennorrhœa is divided into acute and chronic, the former including all forms of purulent ophthalmia, and the latter muco-purulent and granular ophthalmia, the papillary and follicular granulations being considered as different manifestations of an identical disease. The main argument in favor of this is that in an epidemic of ophthalmia all these affections are met, and that a considerable number of instances have been observed in which different affections have followed infection from the same source. Sattler appears, however, to have been mistaken in considering the micrococcus found by him in trachoma as identical with the gonococcus. According to Zehender (Bowman, lecture, *Lancet*, Nov. 27), the trachoma microzoon "is a diplococcus very like the gonococcus, but smaller, and cleft by a tiny line. It can be cultivated in various media, whereas the gonococcus will only propagate in blood serum."

Arlt's book is of interest as embodying the views of one who has probably had a very much larger experience than any living ophthalmologist. It is, however, only the first part of a projected work, and the subjects with which it deals—affections of the conjunctiva, iris, and cornea—are not those which give much scope for originality. Unfortunately, the manuscript appears to have been completed before cocaine came into use; and, although the translator has endeavored to supply the defect by numerous interpolations, the success is naturally but indifferent.

The classification of the different forms of conjunctivitis has been already referred to. The evidence in favor of infection through the medium of the air is fully discussed, a possibility which is consistent both with clinical facts and with what we know of other infecting material. It has, however, been denied by Stellwag von Carion and other authorities. The section devoted to sympathetic inflammation is meagre,

and not up to date. No well-marked distinction is made between sympathetic neurosis and ophthalmitis. The theory of excitation through the medium of the ciliary nerves is adopted; but the arguments that have been adduced against it are not mentioned, neither are Deutschmann's experiments. Indeed, the whole section reads as if it had been written ten years ago. There is an interesting section devoted to the cysts of the iris that occasionally follow a perforating wound, but Hulke's well-known paper on the subject is not referred to. W. A. F.

RECENT WORKS UPON OPERATIVE SURGERY AND SURGICAL TECHNIQUE.

1. THE PRINCIPLES AND PRACTICE OF OPERATIVE SURGERY. By STEPHEN SMITH, A.M., M.D., Professor of Clinical Surgery in the University of the City of New York. A new and thoroughly revised edition. 8vo. pp. 877. Philadelphia: Lea Brothers & Co., 1887.
2. MANUAL OF OPERATIVE SURGERY. By JOSEPH D. BRYANT, M.D., Professor of Anatomy and Clinical Surgery in Bellevue Hospital Medical College, New York, etc. 8vo. pp. xxvi.-530. New York: D. Appleton & Co., 1887.
3. MANUAL OF OPERATIVE SURGERY. By W. ARBUTHNOT LANE, M.B.M.S., F.R.C.S. 12mo. pp. 276. London: George Bell & Sons, 1886.
4. HOW WE TREAT WOUNDS TO-DAY. By ROBERT T. MORRIS, M.D., late House Surgeon to Bellevue Hospital. 16mo. pp. 162. New York: G. P. Putnam's Sons, 1886.

1. THE first edition of Dr. Stephen Smith's magnificent work was issued in 1879, and it has since gone through eight large issues, but without any alteration of the text. The present edition is, therefore, called the "second" by the author, but we think he does himself injustice in so doing. If we understand the matter correctly, this is the tenth edition, and we bear witness that it is "thoroughly revised." This work is too well and too favorably known to require any words of commendation, and its merits effectually protect it from adverse criticism. It is not a manual of operative surgery, but a treatise upon the principles as well as the practice of mechanical surgery, requiring for its elaboration 877 large octavo pages. The subject-matter is brought down to the very latest period, hence we shall find the work to be a faithful exponent of the art of surgery as it is practised now.

So comprehensive is the scope of the work that it might almost be considered a treatise upon the whole science and art of surgery. The opening pages call attention to the "civil obligations of the surgeon," in which it is stated that "whoever undertakes to practise any art or profession assumes an obligation, both civil and professional, which, though implied, has all the force and validity of a formal contract." This obligation requires that he shall possess: 1st, reasonable skill, knowledge, and experience; 2d, that he shall use ordinary care in the exercise of his skill; and, 3d, that he shall use his best judgment. As

the science of surgery is a progressive one, those who practise the art must assume new obligations as advances are made, hence it is held by the author, and we heartily agree with him, that "antiseptis implies new obligations" upon the practitioner, and "if, through ignorance or negligence, he fail, in any given case, to apply these principles with reasonable care and diligence, he would be justly held responsible for any unfavorable results due to conditions which antiseptic treatment would have prevented."

Following such a statement as we have just quoted, it is but to be expected that there shall be a thorough discussion of the principles and practice of antiseptic surgery, and this is done in a simple manner which can be readily understood by any one. Whilst the author is earnest in his advocacy of the antiseptic method, it is with the great principles of surgical cleanliness that he concerns himself, rather than with any special line of antiseptic practice. Surgeons are pretty well agreed at this time upon the best methods of antiseptis, and but few confine themselves to the original Listerism, or to any other rigid and unalterable system. Soap and water for cleansing purposes, irrigation of the wound and the part to be operated on with solutions of bichloride of mercury, carbolic acid solutions for disinfection of instruments, and a combined iodoform and sublimate dressing for the wound, with certain modifications here and there, form the method most in vogue at this time, and the various details of the application of these agents are fully discussed in the text. In view of the splendid achievements of modern surgery we feel tempted to exclaim, "bold is he and with triple brass around his chest who commits his fragile (surgical) bark to the cruel waves" of chance, without first invoking the protection of antiseptis.

A short section is devoted to the consideration of wound fevers, and it does not seem to us that justice is done to these important complications, as but three and three-quarter pages are devoted to them. It also seems to us that the pathology of these affections is more settled than would be expected from a perusal of the context. Many subjects are carefully considered which are usually omitted in works on operative surgery, amongst these are fractures and dislocations. These very important and practical topics are rather briefly, but succinctly, treated.

We are glad to note the judicious conservatism of the author in regard to new and unsettled procedures; thus, in speaking of fractures of the patella his views are eminently wise and conservative. He presents a tabular statement of the results of wiring the patella, as follows: total cases, 182; recent, 81; old, 53; results good, 75; fair, 35; poor, 24; suppuration, 34; amputation, 4; deaths, 11; total ankylosis, 14; not known, 31; under treatment, 9. "In simple fracture without complication, wiring the fragments gives no better results, as far as relates to the usefulness of the limb, than the judicious employment of apparatus," an opinion which tallies exactly with our own. We have never been able to see how it could be justifiable to cause the death of four or five persons in every hundred in order to obtain a slightly better functional result. We are surprised that no mention is made of Kocher's method of reducing dislocations of the shoulder, which is, we believe, a very great oversight, as it is certainly one of the easiest, safest, and most successful of all the many procedures which may be used for effecting reduction of this dislocation.

The section devoted to the osseous system includes fractures, dislocations, diseases of the bones, and joint-diseases; and whilst it is impossible to treat exhaustively of so many subjects in 117 pages, the descriptions of the diseased conditions, and especially the mechanical and operative procedures necessary to remedy them, are clear and practical. The subject of operations upon bone, resections, excisions, osteotomy, etc., is particularly well handled; not only are the usual typical operations described, but the various osteoplastic methods which have come into use during the past few years.

The fourth section is devoted to diseases and injuries of the circulatory system, including ligation of the arteries. The next section is devoted to the diseases of the nervous system, and, as is to be expected, considerable space is taken up with cerebral localization. The remarkable operation of R. J. Godlee is mentioned, but the brilliant work of Victor Horsley is probably of too recent a date to have secured mention in this book. Fluhrer's remarkable case of removal of a bullet from the brain, by trephining upon the opposite side of the head from that at which the missile entered, receives merited mention. Nerve suture and nerve stretching receive brief notice, scarcely as much as their importance demands.

Passing over the chapters devoted to affections of the tegumentary system, the lips, tongue, pharynx, and œsophagus, all of which receive adequate treatment, we pause to seek the opinion of the author in regard to the new operations upon the stomach. He seems to hold a somewhat neutral position in regard to the justifiability of gastro-enterostomy, digital divulsion of the pylorus, and pylorotomy, and prefers to await further developments in regard to them, but says all surgeons should be familiar with the details of these operations. In regard to penetrating wounds of the abdomen, and especially those inflicted by firearms, Dr. Smith says:

"The experience of the past has been that shot injuries of the small intestine are always fatal if treated upon conservative principles, but the experience of the present is that some patients may be saved by exploring the abdominal cavity, cleansing it of all effused matters, and closing the wounds of the viscera."

He, therefore, adopts Senn's dictum that the surgeon who allows a patient to die from a penetrating abdominal wound without, at least, proposing laparotomy "has failed to discharge the duties imposed by modern surgery." Whilst we believe these views to be true in the main, we think they are a little too sweeping. We do not think there is any doubt that recoveries took place after gunshot wounds of the small intestine during the late war, but they were very few in number. Dr. E. G. Waters, of Maryland, reports in the *Medical and Surgical History of the War of the Rebellion*, a case of gunshot injury of the abdomen in which he, at least, considered the small bowel to have been wounded; the patient recovered and was alive and in good health at a recent date.

The consensus of professional opinion at this time is decidedly in favor of laparotomy in these abdominal injuries, and we think justly so, but the question is far from settled. Should laparotomy be performed in every case of penetrating wound? What cases may be left to nature? What are the comparative results of expectant, and of operative treat-

ment, etc.? are questions which further observation will determine, but which will require a great war or series of conflicts for their solution.

The treatment of intussusception is summarized: First, quiet spasm by giving opium or belladonna; second, attempt reduction by forcibly, but gently kneading the bowels, changing the position from time to time. If these measures do not succeed, not more than two days should be allowed to elapse before proceeding to laparotomy. The author's position in regard to laparotomy for intestinal obstruction in general, is that which is held by most surgeons at this time: try medical means, opium, enemata, posture, etc., and if they do not succeed perform abdominal section after the lapse of three or four days.

The length which this review has already reached admonishes us that we must omit any special notice of operations upon the liver, spleen, pancreas, and kidneys, as well as of the radical cure of hernia, all of which will be found carefully considered. The author does not apparently approve of attempting the radical cure of hernia at the time of operation for strangulation, at least there does not seem to be any mention of it. Extirpation of the larynx is recommended in cases of malignant disease within that organ, but the results are not held to be encouraging.

This work will be found to represent the prevailing surgical opinions very faithfully, not only in regard to the recognized operations, but to those which are struggling for recognition as well. We must, however, pass over many subjects of marked interest, and pause at the chapter devoted to amputations; here every form of amputation is described, and amongst these methods none is better in many respects than the "hood flap" of Dr. Smith. The last chapter is devoted to the consideration of "compensative appliances," artificial limbs, etc.

In conclusion, we may be allowed to say that Stephen Smith's *Operative Surgery* is one of the most complete works in the English language, and is a fit companion to Malgaigne's magnificent treatise, after which it is patterned. The wood-cuts are in the main good, and are very numerous. The descriptions of operative procedures are plain, and the opinions expressed conservative and judicious. The work reflects great credit upon the author and upon American surgical literature.

2. With Stephen Smith's and Stimson's works already in existence, Dr. Bryant undertook what would have appeared to most persons an almost impossible task—that is, the preparation of a manual of operative surgery which should possess individual merit to such a degree as to give it a place in the surgical literature of the day. We think he has succeeded to a very marked degree. Bryant's manual is not so comprehensive as Smith's work, and is more closely restricted to operative surgery in its more limited sense; for instance, nothing is said of fractures and dislocations at all, except in connection with wiring the patella. As this subject is one of the live questions of the day, we are pleased to see that the opinion of our author corresponds to that of Dr. Smith, which we have already noted. He says: "In my opinion, this measure should not be employed except for other reasons than that of the existence of a simple fracture of the bone, because I do not believe that it is good surgery to expose a patient to the contingencies of suppuration, amputation, ankylosis, and even death, for the better rectification of an injury, which, at its worst, has no tendency to terminate fatally, and almost

invariably results in a serviceable limb when treated by the ordinary methods." What an enormous amount of literature the patella has been the means of creating, and what diverse views have been held in regard to the proper method of treating its fractures! Almost as much a bone of contention have been Malgaigne's hooks, as the operative treatment, and it is rather interesting at this time to note this fact, as there seems to be a tendency to return to this, as Agnew calls it, "infernal machine."

The first fifty-six pages of the book are devoted to general principles, the treatment of operation wounds, the arrest of hemorrhage, and such other preliminary information as is necessary to introduce the reader "in medias res." The consideration of operations upon the bloodvessels takes up seventy-eight pages. The ligation of arteries is carefully considered, the rules for finding the vessels, the linear, as well as anatomical guides, being carefully explained, and, in most cases, elucidated with appropriate plates. We think this section exceedingly satisfactorily treated, even better than the corresponding section in Dr. Smith's book, for the results of the ligation are given in nearly every case by Dr. Bryant, and are not by Dr. Smith. It is stated that the innominate artery has been ligated 17 times, with 2 recoveries. We presume the author would not make such a statement without authority, but a report of the second successful case has never been brought to our notice. Thomas Bryant, in the last edition of his book, says the innominate has been ligated 18 times, with 1 recovery. Statistics of operations upon the bloodvessels performed in pre-antiseptic times are not of much value now, thus 20 ligations of the radial are recorded as having been performed during the war, with 4 deaths, and 10 of the ulnar with 3 deaths, percentages which are out of all proportion to the inherent mortality of these operations, which may be said to be nothing, when they are done with proper precautions.

The subject of cerebral localization is mentioned, but too briefly to be of much practical benefit; this would seem to be an error in view of the advances made within the past year. Nerve and tendon suturing are recommended in appropriate conditions. Of all operations of surgery none have attained such absolute precision in results, with such a small mortality, as osteotomy for the cure of deformities of the limbs; thus, in about 650 supra-condyloid osteotomies for genu-valgum, only 3 fatal cases occurred as the result of the operation.

Chapters VIII., IX., and X. are devoted to operations upon bones, chiefly to excisions, resections, and amputations, which are well illustrated and correctly described, but require no special notice. Considerable space is devoted to plastic surgery, rhinoplasty, etc.; the remarkable case of Dr. Sabine is mentioned, but no cuts given. We think some of the old cuts might have been omitted, as they have been in every work upon surgery for about fifty years, but the osteoplastic formation of the nose performed by Dr. Sabine deserves more than slight notice, and is well worthy of being illustrated in a work on operative surgery. In this case, the bridge of the nose was lost, and it was restored by attaching a finger to the skin of the forehead, after removal of the nail and the denudation of the palmar aspect of the finger to the middle of the first phalanx. After union had taken place to a degree sufficient to insure vitality to the flaps, the finger was amputated about its middle, and the framework of the nose was thus secured. The soft parts of the

finger and the contiguous tissues of the face were united at the time the finger was secured to the forehead, and an organ formed which gave the man some semblance to a human being, though it did not make him an Adonis, as we happen to know from personal observation.

In speaking of the operations upon the kidneys, nephro-lithotomy is said to have been performed 6 times, with no deaths; these statistics are certainly quite ancient. Dr. S. W. Gross mentions 21 or 22 operations in his article in this journal, with 2 deaths, which makes the mortality about 10 per cent. for completed operations, and nothing for 24 cases in which an exploratory incision was made in the loin, and no stone was found. Henry Morris also gives about the same results. The author is also in error in regard to extirpation of the spleen, when he says, "it has not proved successful, however, in any instance when practised for leucocythæmia." Unless we are quite mistaken, the spleen has been extirpated for leucocythæmic tumor 20 times, with 1 recovery. It is an operation, however, which is absolutely unjustifiable for this disease; and it seems to us that the results are not very "flattering," when performed for other causes, "being in excess of 50 per cent." The author also leaves us to guess which "results" he means, as he does not state whether good or bad. Amongst the methods for radical cure of hernia is one by the author himself, and it is greatly to be regretted that the description of it is not clear and readily understood. It would also have been well if cuts of the procedure had been given.

In none of these works upon operative surgery do we find any account of the methods of Sonnenburg, Thiersch, or Trendelenburg for the cure of exstrophy of the bladder. There is an effort being made by the German surgeons to perform osteoplastic operations for the cure of this dreadful malformation, and it looks as if better results would eventually be obtained than by the ordinary operations of Wood and Maury.

Notwithstanding the few inaccuracies of statement in regard to the results of certain operations and a few other minor defects, Dr. Bryant has produced a valuable book which is fully up with the times. His views upon doubtful operations are conservative, and to our mind judicious, and his teachings may be followed with safety. The mechanical execution of the work is good, the plates and cuts accurate, and a good index is supplied. We congratulate the author upon having placed a good and useful work upon operative surgery in the hands of the profession. It is not so voluminous as Smith's work, having about 350 fewer pages, perhaps not so elaborate or so comprehensive, but it is equally as reliable, and will be almost as useful.

3. Mr. Lane's book is a condensed manual of 276 pages, which is shorn of all superfluous diction to such an extent that only the bare descriptions of the various operative procedures are left, without giving any of the indications for operation, or detailing the results which ought to be obtained. The author in his preface does not state any reason for the publication of this work, and we are left in doubt whether there is "a long-felt want" in England, which a manual of operative surgery will fill or not. The present work is perfectly reliable as far as it goes, but it cannot compare with either of the works mentioned above, and it likewise falls far below Stimson's manual of operative surgery, both in the arrangement of its contents and excellence of its figures.

We have already said that the work is perfectly reliable as far as it

goes, and to anyone who wants a book which can be easily carried in the pocket, and who does not desire to read many details, we can commend the present. The descriptions of the operative technique are good, and the anatomical explanations correct, but we do not agree with the author that it is more convenient to refresh our anatomical knowledge by a reference to the plates of Gray or Quain than to have them in the manual.

The particulars in which the work is wanting, in our opinion, are the following: too great condensation of its contents; failure to express any personal opinion as to the respective merits of various operations; the omission of various operative procedures which are now recognized the world over as legitimate, as Mikulicz's, Tripier's, and Hancock's operations upon the foot, gastro-enterostomy, and digital divulsion of the pylorus, excision of the anus, etc., methods which, though not often required, ought at least to be mentioned in a work upon operative surgery. The figures and plates are entirely too diagrammatic, and are made to do service in too many capacities. It may not be necessary to describe the methods of dressing wounds for English readers, but we think this omission an error. The dressing of a wound, the manner of introducing sutures, and the drainage are matters which are more important than the operation itself in many cases, and wherever it is necessary to instruct anyone in the performance of operations, it is equally as important that he should be thoroughly instructed in the dressing of wounds and in the use of antiseptic agents.

4. Dr. Morris's brochure professes to be "a treatise on the subject of antiseptic surgery which can be understood by beginners," but if this statement is correct we must give "beginners" credit for a very superior order of intellect, as we are sure that it will be very difficult for those who are further advanced to understand a considerable portion of it.

In the preface or "First Word" of the author, the candid statement is made that "this book is modest only in its size," a statement which is amply demonstrated by a perusal of its contents. That the author is a man who entertains strong opinions, and is not afraid to express them is very evident, but if there had been as much modesty in expression as there is in the size of the book, we think the antiseptic cause would have been better served. The cause of antiseptic surgery is exceedingly strong and is sure to prevail, and every attempt to popularize its principles and practice is laudable, but its very strength demands a simple presentation of facts rather than a rhetorical display.

Whilst, therefore, we commend the effort to diffuse a greater knowledge of the methods of antiseptic wound dressing, and of the splendid results of antiseptic surgery as compared with those of pre-antiseptic times, we must positively protest against the bombastic and metaphorical style of the present work. There is a kernel of valuable information in regard to surgical dressings, the materials of which they are made, and where they can be obtained; their cost, and the manner of using them, but it is so encased in a thick shell of verbosity, metaphor, and, in some places, incomprehensible diction that its value is very materially reduced. We may be allowed to express the hope that, when a revision of this little book is demanded, the author will prune it of personalities, anecdotes of doubtful applicability, and ambiguity of expression, and will present the very valuable subject matter in plain language, as befits a scientific communication.

R. W.

VERHANDLUNGEN DER DEUTSCHEN GESELLSCHAFT FÜR GYNEKOLOGIE.
ERSTER KONGRESS.

TRANSACTIONS OF THE FIRST CONGRESS OF THE GERMAN GYNECOLOGICAL SOCIETY. Edited by DR. F. WINCKEL, President, Professor of Obstetrics and Gynecology at the University of Munich, and DR. R. FROMMEL, Secretary and Docent of Obstetrics and Gynecology, University of Munich. Leipsic, 1886.

ONLY last year was a gynecological society formed in Germany, and this volume of three hundred and fifty pages contains the transactions of the first meeting, which was held at Munich, in June, with Winkel, of Munich, as presiding officer. The society commences with a membership of sixty-eight, and among the names are to be found some of the most renowned obstetricians and gynecologists of the world. Among them the Brauns, the Veits, the Freunds, the Schwartzs, Credé, Fritsch, Hofmeier, Martin, Müller of Berne, Breisky, Leopold, Olshausen, Säger, Scanzoni, Schauta, Schröder, and Zweifel, names familiar in this country.

The transactions of this society will be scanned with interest, as indicating the kind of work that is being done, the direction of professional labor, and the amount of progress being made in a country which has contributed so much to this important branch of medical science.

Looking over the volume, and classifying its contents, we find that of the thirty papers three are upon anatomico-physiological subjects, two upon subjects of general interest, one presenting an electro-lighted speculum, and one, which, with the discussion, occupies twenty-five pages, upon the prophylaxis of ophthalmia neonatorum. The others are equally divided between subjects purely gynecological and obstetrical, and of the latter five are devoted to the puerperal state. So great an attention to obstetrics in a society ostensibly devoted to gynecology, is another illustration of the intimate natural connection between the two branches, and suggests the inquiry whether two subjects touching each other at so many points, and so mutually inter-dependent, can be profitably separated by special societies for each.

Looking critically at the papers, their marked practical character is apparent at once, and is, indeed, their most striking characteristic. With but one exception is there any amount of space devoted to disquisitions purely theoretical. The papers are the record and presentation of practice, and of the writer's experience. The same remark may be made of the discussions, and the fact is very striking when the Cæsarean section is under consideration, from the number of members who give personal experience of an operation which is, in this country, comparatively a rare one.

We select a few of the papers, most important in regard to their practical aspects, for a very brief presentation of their contents.

The first paper is by Müller, of Berne, on the "After-treatment of Severe Laparotomies." The danger of septic infection after laparotomy is now reduced to so low a point as to approach to zero, while there yet remain the dangers from shock, hemorrhage, thrombosis and embolism, tetanus, and disturbances of the function of the bowels. To the last the paper is entirely devoted, and it should have been entitled accordingly.

Disturbed intestinal action of any degree up to complete obstruction, which has frequently resulted fatally; may be caused by exudation around the pedicle in Douglas's cul-de-sac, by adhesion of the intestines to the pedicle, to the line of incision, or by adhesion of coils to each other. For these consecutive accidents the author proposes two remedies: 1, the abandonment of the bandage in all cases in which there are extensive injured surfaces of the abdominal cavity; 2, the introduction of some substance to keep the surfaces apart until healed. Such a substance should be aseptic, harmless, unirritating, and readily removable. It must necessarily be liquid, and Müller believes he finds all the requisites in a seven per cent. solution of common salt. A case is related in which this course was pursued, followed by some severe symptoms, due, the writer thinks, to rapid absorption of a large quantity of liquid; and the paper closes with consideration of means to effect a constant flow of the fluid into and out of the abdominal cavity. Whether worth while to put in force, in every case, a complicated process for the escape of a comparatively rare accident, was not touched upon in the discussion, which gave, nevertheless, several points of much interest. Experience of the speakers plainly showed that such adhesions did not always cause any symptoms, as proved by autopsies and by second operations; also that it is not safe, in a second laparotomy, to go down through the scar of the first; one speaker having, in this way, divided the small intestine in two-thirds of its circumference. Elischer, of Buda-Pesth, and Küstner, of Jena, drew and stitched together the peritoneal edges of the pedicle, thus covering the new surface. The most important point, however, is the influence of different antiseptics in preventing these accidents, and the widely varying experience and views of individuals as to this influence. Thus, Kaltenbach, of Giessen, thinks that these accidents have diminished in frequency under his observation by a more tender toilet of the peritoneum, and by the avoidance of too concentrated antiseptics. At the same time his experience has shown that these adhesions result from circumscribed areas of inflammatory action "due to unsatisfactory asepsis," and he has observed a striking difference since he changed from carbolic acid to corrosive sublimate—1 to 6000.

"The contrast with disinfection by carbolic acid is very striking. During the time that I used carbolic acid I had two fatal cases of obstruction of the bowels in twenty-four operations, dependent upon circumscribed purulent inflammation with consequent adhesion of intestines. Since I have used corrosive sublimate I have not had a single case of this kind in fifty-four operations."

On the other side comes Saexinger, of Tübingen, with one hundred and thirty-one laparotomies, and a very careful cleansing of the peritoneum, without a case of intestinal complication. Then, again, Krukenberg, of Bonn, has observed intestinal obstruction, and attributed it to the use of a too concentrated solution of the sublimate. The number of cases and strength of the solution are not stated. He has, therefore, abandoned the use of the mercurial antiseptic, and since then has had no accident of this kind.

In direct connection with this subject comes the paper by Elischer, of Buda-Pesth, on "Poisoning by Iodoform after Severe Operation." The writer gives in detail several cases in which severe and dangerous symptoms followed the dressing of wounds with iodoform. These symp-

toms seem to have been similar to those observed by Treves¹ and described by him as acute iodoform poisoning. The cases might easily have been taken for inflammation of the meninges. There was sudden delirium with excitement and vomiting. In some cases jaundice was present and in others great depression of strength without apparent explanation. Great frequency of the pulse—140—and a pulse out of all proportion to the temperature—pulse 120, temp. normal—seem to have been almost always present. This differs from Treves's observations of a temperature rising to 104°, or even 106°. From these cases the writer believes himself justified in sounding a note of warning as to the free use of iodoform upon extensive wounded surfaces. There is no notice of any cases similar to Treves's chronic iodoform poisoning, nor is any eruption spoken of. One member, however, had observed violent itching of the skin in one case.

The discussion upon this paper is most valuable in two important practical aspects. It embraced the subject of the paper proper and also the curability and operative treatment of tubercular peritonitis. The views of the different speakers are, therefore, arranged and presented under these two heads.

In regard to iodoform poisoning it is to be observed, first, the expression of doubt as to iodoform being always the cause of the symptoms given. Slaviansky, of St. Petersburg, had seen just such a case of disturbances of the nervous system, a constantly rising pulse with a temperature not above 98.4°, and considered it to have been a case of intoxication by iodoform. The autopsy, which was thoroughly made, "gave a perfect picture of septicemia." Battlehner saw a case of mania following and attributed to iodoform, which, after cure in an asylum, presented a recurrent attack. Chrobak had seen one case in which the symptoms given above were present when no iodoform had been used. Second, while in regard to explanation of the anomalous symptoms there were some voices in favor of that refuge of lacking knowledge, idiosyncrasy, considerable evidence was presented that fatty subjects seem more likely to be injuriously affected by iodoform. Doubtless the theoretical proposition of Chrobak is sound, that, as with ether so with iodoform, the condition of the kidneys should be carefully investigated, and that much depends upon their excretory power. Third, whatever the explanation of the origin of the toxic effects may be, abundant evidence is here adduced that these effects are altogether exceptional in occurrence and that iodoform has been used very freely, and in large numbers of cases without any injurious consequences. To the interior of the uterus it has been repeatedly applied in quantities of six to ten grammes; one speaker says bad symptoms are never caused by less than ten grammes; Chrobak always uses it freely in all laparotomies, injuries of the parturient canal, retention of portions of placenta, has used it in "hundreds of cases" and seen no bad symptoms as a consequence. The positive statement made in this country that "iodoform, in greater quantity than forty-five grains, will give rise to poisoning,"² seems, therefore, not to be sustained by this testimony.

The subject of the operative treatment of tubercular peritonitis was introduced by the report of two cases by Frommel, which were treated

¹ Practitioner, October, 1886. This journal, January, 1887, pp. 246, 277.

² Weir: Trans. N. Y. Acad. Med., vol. iv. p. 190.

by laparotomy and "thorough iodoforming" of the peritoneal cavity. Both yielded a brilliant result. During the discussion two other cases of like character were related. But that the recovery in these cases did not depend upon the iodoform was speedily made apparent. One case is reported cured in which the abdomen was sponged out with solution of carbolic acid, and another in which corrosive sublimate was used, the patient dying eight months afterward of phthisis. Two cases were cured by tapping alone, one of them undoubtedly suffering from pulmonary phthisis, which caused death a year afterward, and in one case laparotomy alone removed a very large quantity of fluid which never reaccumulated. In this case there was no part of the peritoneum as large as a small coin (pfenniggrösse) which was not studded with tubercular deposit. Of course, the question of accurate diagnosis as to the character of the deposits was not passed over. In one of Frommel's cases the "papillary excrescences" were evidently "granulation tissue," and that they are not always tubercular, was argued from Spencer Wells's case.¹ Nevertheless, the subsequent death of several of the patients from tubercle elsewhere would seem fairly to prove the nature of the peritonitis which gave rise to the ascites, and in addition the number of cases in which specimens were exsected and submitted to microscopic examination was so great as to leave no shadow of doubt as to their character, despite the position of one speaker that no diagnosis could be satisfactory where the presence of the tubercle bacillus had not been demonstrated. Further than this, it appeared from the experience of members that tubercular peritonitis is by no means the fatal disease it is generally held to be. Not only does it show "a surprising tendency to recover after operative measures," but in many cases it heals spontaneously, or may disappear for years. Two cases of spontaneous recovery are related, the patients dying afterward of phthisis.

Sänger opens a paper upon "Simplification of the Cæsarean Section," with the admission that, although with modern use of antiseptics and our increased knowledge of abdominal surgery, the "classical simplicity" of the operation has been forever left behind, yet that it has been made too complicated, and that, to be of service, its technique must not be such as to require the skill of the practised laparotomist, but must be brought within the range of surgeons in general. He therefore lays down the steps and measures of the operation which he now deems essential, as derived from larger experience. He prepares the patient as for any abdominal operation, using carbolic acid or sublimate as disinfectants, and only two assistants besides the midwife, who will care for the child, are required. The anæsthetic may be committed to a layman, a point which was justly protested against in the debate. The incision is made in the median line passing, if necessary, through the navel. The application of pressure-forceps, and the provisional sutures for drawing together the abdominal walls to prevent escape of the intestines, may be dispensed with. The turning out of the uterus before incising it is not necessary, except when the child is dead, or when sufficient assistance is not present to prevent entrance of uterine contents into the abdominal cavity. If the placenta be under the uterine incision, either cut directly and rapidly through it, or peel it off sideways as quickly as possible. In three cases he has pursued the former course once and the latter twice.

¹ Ovarian and Uterine Tumors, 1882, p. 101.

The child is then extracted, and during or after this step the uterus is turned out of the abdomen, the walls of which are drawn and held closely together behind it, so as to prevent all ingress of fluids; the intestines, if escaped, covered by, and the uterus laid on, disinfected napkins; constriction of the cervical portion may be by manual compression, or "by twisting the uterus on its long axis," instead of by the elastic cord. "In the interest of simplicity," the undermining or dissection of the peritoneum, and the resection of the muscular structure of the uterus, have been abandoned. The uterine wound is closed by eight to ten deep sutures passed through everything except the decidual surface, and preferably of soft silver wire, after which from sixteen to thirty sutures of fine silk are passed through the serous membrane, twice on each side, as in the Lembert suture for the intestines. Closure of the abdominal wound is as usual, and the after-treatment "as inactive as possible." An ice-bag is placed on the abdomen as the patient is put to bed. The following are the statistics:

The total number of cases now amounts to 30, with recovery of the mother in 21—73.3 per cent; 27 children saved—90 per cent. Deducting 3 American cases, all fatal, there remain 27 cases for Germany and Austria, with 22 recoveries—81.5 per cent. At the front stands Leopold with 11 cases—10 mothers saved and 11 children. The three clinics of Leipsic, Dresden, and Innsbruck have had, altogether, 19 cases, with 18 mothers saved—94.7 per cent.; and 19 children—100 per cent.

Much of the discussion was taken up with questions of priority and on the relative value of silver and silk for the deep uterine stitches. Säger allows either, but prefers silver, while some preferred silk, and doubted the safety of silver if the operator is not skilled in fastening it. Schauta advocated the silver suture strongly, and gave the following statistics: Of 17 cases in which silver sutures were used, not one died; while there were 7 fatal cases out of 10 in which silk was used. He justly says that septicæmia could not explain this marked difference. Priority as to Säger's particular mode of bringing together the peritoneum was denied, but again strongly claimed by him in closing.

Leopold's remarks are of great value, from the large experience upon which they are based, and because in every case he has "sought to place himself in the position of the practitioner, and aimed to attain the greatest possible simplicity and safety of the operation as performed in private practice." He is in favor of turning out the uterus before incising it, and says that this can be done without much difficulty. He also recommends the provisional stitches through the abdominal walls in order to draw them together behind the uterus—a proceeding which he "cannot too strongly recommend." He then puts on the rubber constrictor, fastens it with a clamp forceps, and only draws it up tight after removal of the child. He does not express himself as to incising or peeling off the placenta, but other speakers expressed themselves strongly in favor of going directly through the placenta with the hand, if possible.

However much the value or novelty of Säger's contributions to the modern Cæsarean operation may be questioned, this much was accorded him here and passed unchallenged: He has rendered the great service of having advocated the old and classic method at a time when all were marching under flying banners in support of the Porro operation. By

the extraordinary improved results of the modern method he has widened the range of application of the operation and lessened its mortality.

The operation of shortening the round ligaments for retroflexion is considered in a paper by Zeiss, of Erfurt, entitled "Zur Alexander-Adams'schen Operation." He advocates the procedure, and presents his experience of three cases modestly in view of the "cold and cautious reception given to this operation in Germany." All the three patients are thankful that he has operated upon them, but in neither of them has a year yet elapsed. The paper having opened with a criticism of some objections made by the President in his recently published work,¹ Winckel replies. His objections are purely theoretical and, therefore, such as must yield to experience; the strongest one is that sufficient time has not yet elapsed to test the results. The principal speakers besides, were Slaviansky and Mundé, of New York, both of whom present considerable experience with the operation which gives valuable testimony as to the difficulties of performing it and its results. The former has had sixteen operations; twice the ligaments were not found at all, and five or six times unsatisfactorily; when found the operation was "typical, easy, and brilliant." The latter reported seven cases, the ligaments found in three and not found in three others: in the seventh, found on one side and not on the other. As to results, they seem to be favorable so far as tested. Mundé says: "I believe the operation has a future, albeit a restricted one." Slaviansky's opinion is as follows:

"I will, therefore, only say of the Alexander operation that it is entirely justifiable for certain selected cases, and for certain forms of retroflexion, the uterus being freely movable; but it is impossible to say in advance whether the operation can be performed or not. It does not, therefore, at present stand on a very wide foundation, and much investigation is yet necessary in order to be able to say how, when, and in what cases it is practicable."

We have preferred to occupy the space at our disposal with a fair epitome of a few subjects of practical interest rather than to attempt a *résumé* of each paper which could but be unsatisfactory from its brevity, or to consider papers in which unsettled questions are discussed rather than addition made to our knowledge. For the benefit of those who may be interested in the subjects, we give the titles of the principal remaining papers, with names of the authors:

Bayer: On placenta prævia.

Fehling: On the relation between the composition of the blood of the pregnant woman and that of the amniotic fluid.

Sänger: On examination of the ureters in woman by the touch.

Winckel: On the doctrine of internal puerperal erysipelas.

Bumm: On the etiology of puerperal cystitis.

Stumpf: On puerperal eclampsia.

Runge: On the general treatment of puerperal septicæmia.

Sänger: On the relations of gonorrhœal to puerperal disease.

Schätz: On ulcers of the female bladder.

Schauta: On the operation for recto-vaginal fistula.

Küstner and Korn: On perineorrhaphy—two separate papers.

Olshausen: On the early stages of myoma clinically considered.

Küstner: On cocaine in plastic surgery.

¹ Lehrbuch der Frauenkrankheiten. Leipzig, 1886.

Finally, we can but congratulate our medical brethren of Germany on the formation of this Society, and on the excellent showing both as to quantity and quality of the first volume of its transactions. The high expectations excited by the array of distinguished names at the opening of the volume are not disappointed by perusal of its contents.

J. C. R.

SPASM IN CHRONIC NERVE DISEASE. THE GULSTONIAN LECTURES, DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS OF LONDON, March, 1886.

By SEYMOUR J. SHARKEY, M.A., M.B. Oxon., F.R.C.P. London: J. & A. Churchill, 1886.

IN the unpretentious little work, *Spasm in Chronic Nerve Disease*, Dr. Sharkey has taken a general view of the subject of muscular spasm in chronic cases, but he has also collected a fund of clinical material so illustrated with interesting and valuable observations, that he has done much to put in compact form what is now known of a very difficult problem in neurology.

There is nothing so dark in the general obscurity of nervous diseases as the study of the cause of spasm. Hence, to throw light on this branch is, indeed, a work to be commended, and Dr. Sharkey has cause to be congratulated on his selection of a subject for the Gulstonian Lectures. An investigation into the cause of spasm in organic nerve disease is at present highly interesting, in view of the mapping out of the brain into motor centres and sensitive areas, and the general localization of the functions of that organ. Dr. Sharkey divides his lectures under the following heads: (1) spasm in connection with cerebral motor mechanisms; (2) in connection with spinal mechanisms; (3) functional spasm.

In the consideration of the first division of spasms Dr. Sharkey necessarily goes into the discussion of localization of brain functions, and in describing the motor area of the cortex refers to an explanation of a long-observed clinical fact,

"that in hemiplegia, in connection with disease of the central ganglia, the arm is usually more paralyzed than the leg. For hemorrhages from the branches of the lenticulo-striate artery would, from their position, press more upon the anterior than the posterior division of the motor segment of the capsule, and this is the vessel which most frequently bleeds."

The probable explanation of this is, that the fibres of the arm in the capsule are anterior, and those for the leg lie posteriorly. Dr. Sharkey seems to doubt the exact diagnostic value of knee-jerk and ankle-clonus, etc. This spasm must be studied with regard to the condition of the patient. For instance, Dr. Sharkey says:

"A man suffering from extreme debility and anæmia came to my out-patient room, and the house physician called my attention to the fact that he not only had very extensive knee-jerks, but as marked knee- and ankle-clonus as I ever saw. He was sent into the hospital, and after two days' rest in bed I was unable to elicit even the slightest clonus."

A most interesting series of cases is given in the first lecture, showing the pathological conditions which produced tremors and spasmodic contraction of muscles. These cases are made more clear by illustrations.

In the second lecture the subject of spastic paralysis is taken up, and some very interesting pathological histories are given. In this lecture, as in the first, the connection between the cerebral system of fibres and the clinical phenomena of spasm is discussed.

The following lecture is devoted to the spinal system and the diseased conditions of that organ which produce the spasmodic contraction of muscle. A short summary of functional spasms, including histrionic spasm, writers' cramp, pianists' cramp, etc., conclude the work, which will be found to be of special interest to all those who study the nervous system or who are interested in physiological pathology. J. V. B.

THE HEALING OF ARTERIES AFTER LIGATURE IN MAN AND ANIMALS.

By J. COLLINS WARREN, M.D., Assistant Professor of Surgery at Harvard University. 8vo pp. 184. New York: William Wood & Co., 1886.

DR. WARREN'S work on this subject of never-failing interest to the surgeon, though laboring under the disadvantage of following so closely on Dr. Senn's admirable paper on the same subject, will certainly attract much attention.

We find first a very elaborate and complete review of the history of the ligature. This has been so exhaustively treated, comparatively recently by a number of writers, notably by W. Griefenberger, Adamkiewicz, and Senn, that it would be difficult to present anything very new on the subject. The principal conclusions at which the author arrives, partly from numerous ligations performed on dogs and horses, partly from examination of specimens obtained from the human subject, are: First, the length of time required for complete repair—three to six months in larger arteries; second, the influence of traumatism and septic processes on the size of the thrombus, which was usually very small in aseptic cases; third, the very small part taken by the endothelium in the cicatrization; fourth, the complicated character of the healing process, a principal part being taken by a mass of granulation tissue surrounding the vessel, compared to the so-called provisional callus in fractures. This is said to invade and cause absorption of the fibres of the adventitia, causing the wall of the vessel where compressed by the ligature to expand, the granulation-tissue thus invading the lumen of the vessel. Lastly, and this is the condition which will be most freely criticised, the author claims that there is an active proliferation of the muscular cells of the media, and that these play a not unimportant part in the whole process.

With regard to the relative importance of the endothelium and the granulation-tissue formed outside the vessel, a comparison of Dr. Warren's plates with those of—*e. g.*, Raab (*Arch. f. Klin. Chir.*, 1878, xxiii. "U. d. Ent. d. N. im Blutgefäß. n. der Unterbind.")—will we feel sure go far toward convincing the reader that the differences depend on the numerous and often trifling variations in the performance of the experiment—*e. g.*, the extent of the incision, laceration or bruising of surrounding tissue, with, probably most important of all, success or failure in preserving asepsis. Dr. Warren states that in many of the experiments

no special effort was made to keep the wound aseptic, and that, as a rule, they healed rapidly in the deeper portions, but a small subcutaneous cavity was almost invariably found containing serum, muco-purulent fluid, or pus as the case might be. Occasionally a small fistula led down to the ligature, and in a few considerable suppuration took place.

Now, in the last two sets of cases always, and in the first at least very often, we are dealing with infected wounds, in which an inflammatory process, very different from mere repair, is going on, an inflammatory process which could very well account for the abundant ensheathing callus, and the extent to which the vessel wall was softened and replaced by connective tissue. It seems to us to impair seriously the value of Dr. Warren's conclusions, at least as applied to cases where no infection occurs, that some pains were not taken to avoid suppuration, or at least the presence or absence of infection noted. That in most cases suppuration did not occur around the ligature, which was generally encapsuled in the callus, will not alter matters greatly for those who have noticed the extent to which bacteria often infiltrate surrounding tissues without necessarily causing them to break down. Smooth, muscular tissue is not always easily distinguished, and the non-participation of the muscle cells in the cicatrization has been maintained by so many excellent authorities with such "singular unanimity," as Dr. Warren himself says, that one is tempted to think that there may be good grounds for such a consensus of opinion.

R. J. H.

THE NATIONAL DISPENSATORY: CONTAINING THE NATURAL HISTORY, CHEMISTRY, PHARMACY, ACTIONS, AND USES OF MEDICINES. By ALFRED STILLÉ, M.D., LL.D., Professor Emeritus of the Theory and Practice of Medicine in the University of Pennsylvania, and JOHN M. MAISCH, Phar. D., Professor of Materia Medica and Botany in the Philadelphia College of Pharmacy. Ninth edition, revised and improved. Imperial 8vo. pp. xv. 1781. Philadelphia: Henry C. Lea's Son & Co., 1886.

THE National Dispensatory is so well and favorably known on both sides of the Atlantic that scarcely anything is left to the reviewer except to call attention to the fact that another edition of this valuable work has made its appearance.

This last edition surpasses even its predecessors in thoroughness and accuracy. The fact that in 1884, when the third edition was published, no revision of the British Pharmacopœia had been made for seventeen years has necessitated a thorough going over of the whole work in order that the references might correspond to the last revision of the work of our British cousins. In addition to these changes is a fairly full *résumé*, in the form of addenda, of the more important drugs which have come into general use in the last two or three years, chief among which may be mentioned antipyrin and cocaine hydrochlorate.

Professor Stillé finds an opportunity, under the headings of antipyrin and thallin, to attack once more the use of antipyretics on general principles, and the whole tone of the article on these two drugs, as well as the references alluded to, is decidedly adverse. While it cannot be

doubted that in certain cases antipyrin has produced untoward symptoms and even death, it is also a fact that considering the widespread use of this remedy comparatively few disagreeable effects have been noted.

As to the attack on antipyretics in general it can only be said, with all deference to the opinions of Dr. Stillé, that his statements are arrayed against the opinion of the profession in general in this respect, and that the daily clinical experience of an exceedingly large body of able men still leads them to the use of such drugs.

By far the fullest article on these newer remedies is devoted to cocaine. In the space of eight pages the derivation, history, and medicinal properties of this valuable remedy are quite thoroughly considered, and the drug is spoken of as "a precious discovery." The new basis for ointments, lanolin, receives favorable notice, while menthol and urethan also come in for their share of attention. H. A. H.

DE L'INTERVENTION CHIRURGICALE DANS LES AFFECTIONS DU REIN.

Par AZARIE BRODEUR, M.D., Professeur à l'Université Laval à Montréal, etc. Avec cinq planches en chromolithographie et neuf figures intercalées dans le texte. 8vo. pp. 576. Paris: G. Masson, 1886.

SURGICAL INTERVENTION IN RENAL AFFECTIONS. By AZARIE BRODEUR, M.D., etc.

To anyone interested in the surgical affections of the kidney and the operations performed for their relief, this attractive-looking volume, which appears to be based upon a thesis for the doctorate, holds forth, on superficial examination, the promise of a rich intellectual treat. A careful study of its contents, however, shows that the subjects embraced in its pages have, as a rule, been imperfectly discussed, and that it should include conclusions drawn from an analysis of upward of five hundred operations that had been recorded up to the time of its appearance, instead of three hundred and twenty-seven cases collated by the author, many of which are incorrect and evidently quoted without consulting the original authority.

The operations for calculous affections are hopelessly mixed. In a table of twenty-five nephrolithotomies are included seven cases which are not illustrations of that procedure at all; while nephrotomy and nephrolithotomy are used as convertible terms for the removal of stones from pyelonephritic kidneys. In his table of forty-four nephrectomies for calculus associated with suppurative lesions, thirteen operations are recorded in which a stone was not present; while his table of nephrotomies for suppurating kidney embraces only fourteen cases, when in point of fact he ought to have collated more than ninety cases. In addition to these serious defects and omissions, he discusses the various operative procedures in four pages, so that this portion of the work is practically valueless.

In concluding this brief notice of a work that has no *raison d'être*, we take pleasure in stating that it has one redeeming feature, namely, the indications for and against surgical intervention are fairly stated, and agree, in the main, with the conclusions reached by recent writers and

operators. Thus, Brodeur teaches that nephrectomy should be resorted to only after the failure of other measures for floating, calculous, suppurating, hydronephritic, and cystic kidneys; that it may be practised for carcinoma if the general health is not impaired; and that it is indicated as a primary measure for urinary fistulæ, and sarcomatous and other tumors.

OUTLINES OF THE PATHOLOGY AND TREATMENT OF SYPHILIS AND ALLIED VENEREAL DISEASES. By HERMAN VON ZEISSL, M.D., late Professor at the Imperial Royal University of Vienna. Second edition, revised by MAXIMILIAN VON ZEISSL, M.D., Privat-Docent at the University of Vienna. Authorized edition; translated, with notes, by H. RAPHAEL, M.D. 8vo. xii. pp. 402. New York: D. Appleton & Co., 1886.

THESE outlines of Zeissl's are too modestly named, for his work is a most full and detailed one, and leaves but little for such filling up as might be proper if his subject were dealt with only in outline. Certain critics have remarked that the part devoted to pathology is disproportionately large, and that in which treatment is discussed disproportionately small. We do not concur in this criticism. The fact is, that while there is still room for much debate as to the exact nature of the different venereal diseases—although we have settled convictions in regard to this matter—there is not much room for discussion as to the best methods of treating them.

Zeissl is a dualist, and in his Introductory states briefly and clearly the reasons which to him (and to us) seem to establish conclusively the essential difference between syphilis and other venereal diseases, namely, the venereal ulcer and gonorrhœa. Gonorrhœa Zeissl calls "venereal catarrh," and the venereal ulcer he calls "*schanker*," in his own tongue; or "chancreoid," borrowing the French term. We regret that the translator of his work has made use of the term "soft chancre" for the German term "*schanker*," since we have frequently occasion to observe that, what might seem so innocent, leads to confusion in the minds of those who are not perfectly familiar with the history of modern opinions in regard to venereal diseases. Another error of the translator consists in his translation of the German term "*sklerose*" by "sclerotic ulcer." He is, of course, aware that neither sclerosis nor ulceration is conclusive as to the nature of a venereal lesion, and that the more of the one there is, the less there will be of the other. Many writers in our own language have settled upon the term "initial lesion of syphilis" as the most unequivocal one to apply to what it describes, and we hope that their example may be followed when another edition of the work we are reviewing appears.

We have no space to speak in detail of the teachings of Zeissl in regard to the different manifestations of the venereal diseases, although we may express some surprise that the section devoted to the site and form of the "Hunterian induration" (an ill-chosen term for the initial lesion of syphilis) makes no mention of the urethra. Zeissl has come to the conclusion that extirpation of the initial lesion of syphilis, however

early performed, does not prevent the outbreak of later manifestations, and he doubts whether the earliest possible cauterization is of any use.

In regard to the treatment of syphilis, we note that Zeissl considers expectant treatment as suitable to all "recent cases of acquired secondary syphilis," as well as to all cases in which a febrile disease supervenes. If the phenomena of the secondary period resist expectant treatment for eight or ten weeks, treatment with iodine may be commenced, and this is applicable to *all phases* of syphilis. In fact, relapses occur less frequently after an early treatment with iodine than after the use of mercury. Of the preparations containing iodine, the iodide of sodium and the iodide of iron are the best. The latter is especially suited to anæmic cases. Iodoform is also useful in some cases.

We call attention to this point because it has appeared to us that the opinion that iodine is adapted to the treatment of the earliest stages of syphilis, has not secured the practical assent of English- and French-speaking medical men which it deserves. It does not seem to be generally known that Sigmund, in his later years, came to reverse the old theory that mercury was the best remedy for early syphilis, and iodine for its later stages. We are glad to observe that Zeissl states that "Too much stress cannot be laid upon the fact, that even in the gravest forms of syphilis the preparations of iodine alone will often be found sufficient." And, again, "The preparations of iodine are adapted to all forms of syphilitic disease." And, as to mercurials, he says: "The mercurials generally accomplish more if they have been preceded by a course of treatment with iodine."

With this we must close our review. Zeissl's work does not need more praise than it has long since received. As the result of an enormous experience, and of a most thorough study of the subject of venereal diseases, it is invaluable to every syphilographer, and its practical teachings ought to be familiar to every one who undertakes the treatment of venereal diseases.

As a book, this translation is a credit to the publishers, and in the main to the translator. We would suggest, in addition to what has been said above, that it would be an improvement if the prescriptions were translated into the terms of our U. S. Pharmacopœia, and, even if this were not done, that they should be put into correct Latin.

C. W. D.

A TREATISE ON THE DISEASES OF THE NERVOUS SYSTEM. By WILLIAM A. HAMMOND, M.D., Surgeon-General U. S. Army (Retired List), etc. With one hundred and twelve illustrations. Eighth edition, with corrections and additions. New York: D. Appleton & Co., 1886.

THE fact that an eighth edition of Dr. Hammond's work has been called for is sufficient proof of its standing in the American profession, but when the preface of the seventh edition calls attention to the fact that it has been translated into French, and that an Italian translation was at that time going through the press, it is very evident that the first systematic treatise on nervous diseases published in America has commanded decided attention abroad.

Certainly, in point of lucid arrangement and classification, Dr. Ham-

mond's work is an admirable treatise on an important special branch in medicine, and its popularity shows what a demand there is for it both by students and active practitioners. Whatever work may have been done before, and whatever names may have been known in England and on the Continent as prominent in this special branch of medical research, Dr. Hammond was the first in America to collect the material for a systematic work on the diseases of the nervous system, and he performed his task so cleverly that his book, after passing through eight editions, remains practically the same to-day as it was when the plan of it was first conceived. It contains the same classifications and divisions, amplified by fuller knowledge, and made more valuable by the observations of many of his co-laborers in neurology.

Dr. Hammond's book has been so often and so favorably reviewed that it will be unnecessary in the present notice to consider any other than the new portions of the edition. Before, however, referring to these sections, it is due to Dr. Hammond to allude briefly to some important observations which are to be found in the older portions of this treatise.

The term *neurasthenia* which is so prevalent, and of which most neurologists are so thoroughly tired, is not mentioned, and all symptoms usually included under that head are classed as cerebral congestion. The line of division between some cases of mild melancholia and so-called cerebral congestion is so indefinite that it would seem necessary to describe an intermediate condition which would include the abdominal symptoms of these cases, and especially the series of marked sensations which seem to arise from some disturbance of the abdominal sympathetic system. Exophthalmic goitre is very appropriately included under cerebro-spinal diseases, and the description of this remarkable trouble is both graphic and instructive.

Dr. Hammond still adheres to the consideration of *athetosis* as a distinct disease, though most observers will agree with Charcot that it is simply a symptom of certain forms of *hemiplegia*. Any disease of so complicated an organ as the brain must necessarily show many anomalies, and this anomalous consequence either of *paresis* or *paralysis* can never be traced as a distinct disease.

Convulsive tremor is the name given in this work to a class of peculiar cases which border between *hysteria* and *epilepsy*, and to which Dr. Hammond has been among the first to call attention. No one who has met these obscure and puzzling cases can fail to be thankful for an account of this disease, however imperfect or unsatisfactory it may be. The fact that such conditions may be cured, or, to state it more correctly, may recover can be attested by the writer of this review. Yet any one of limited experience, who is unacquainted with the observations contained in the chapter now under consideration, would be led to think that a favorable result in convulsive tremor is neither possible nor probable. Only lately a case of convulsive tremor has come under the writer's notice which was diagnosticated by a neurologist as one of brain tumor, and death was predicted in a few months, yet the patient improved under appropriate treatment, and progressed within a year to entire recovery.

In the present edition a new section is added on "Certain Obscure Diseases of the Nervous System." Of these diseases, Dr. Hammond says: "Under this head I propose to consider certain affections obviously due to derangement of the nervous system in some one or more of

its parts, but which are only known by their symptoms, there being no definite knowledge relative to their exact seat, nor in regard to the essential nature of the existing disturbance." The diseases claiming consideration in this section are tetany, Thomsen's disease, and miryachit, and kindred affections. The first two, though well known, are certainly obscure, but to see this last it seems necessary to travel far, for Dr. Beard went into the wilds of Maine to find the jumpers, and Lt. McLean, of the U. S. Navy, made his observations of miryachit in northern Siberia, and a French observer has noticed a similar morbid condition among the Malays, which is called in that country Latah.

Dr. Hammond says of these curious "nervous manifestations:"

"I am not able to give any certain explanation of the phenomena of 'miryachit,' or of the 'jumpers,' or of certain of these cases of sleep-drunkenness, which seem to be of like character. But they all appear due to the fact that a motor impulse is excited by perceptions without the necessary concurrence of the volition of the individual to cause the discharge. They are, therefore, analogous to reflex actions, and especially to certain epileptic paroxysms due to reflex irritations. It would seem as though the nerve-cells were very much in the condition of a package of dynamite or nitro-glycerine, in which a very slight impression is competent to effect a discharge of nerve force. They differ, however, from the epileptic paroxysms, in the fact that the discharge is consonant with the perception—which is, in these cases, an irritation—and is hence an apparently logical act, whereas in epilepsy the discharge is more violent, is illogical, and does not cease with the cessation of the irritation."

Dr. Hammond has also added to his treatise by incorporating in it the appendix of Dr. Labadie-Lagrave, which was added to the French translation of a former edition of this work.

The section on "Diseases of the Sympathetic Nervous System" is, with the exception of a few notes in brackets, drawn entirely from this source.

The sections on "Cerebral Syphilis" and the "Symptomatology of Cerebral Lesions" are also translated from the work of Dr. Labadie-Lagrave. The last chapters of the section on "Cerebral Lesions and Cerebellar Diseases," including copious annotations by Dr. Hammond, are probably the most lucid explanations of these subjects that we can find in any general treatise on the nervous system.

A translation of "Conclusions Concerning the Diagnosis of Diseases of the Brain," contained in Nothnagel's work *Topische Diagnostik der Gehirnkrankheiten*, is appended to this section, and these formulated symptoms, together with the preceding chapters, make a most interesting *résumé* of what is now known on the subject of localization of brain lesions. This branch of neurology is now attracting so much attention, and in some directions making such signal progress, that the author has certainly added much to the value of the book by making the discussion of the subject as full and comprehensive as the limits of a general treatise would allow.

Of the numerous works on diseases of the nervous system that have appeared in the last few years, it is not too much to say that Dr. Hammond's is the best in many ways: it is very practical, the style is clear and precise, the descriptions are graphic, and treatment is full and satisfactory. During the fifteen years that the book has been before the profession, much progress has been made in neurology. Many changes have been made, but this last edition will be found to be carefully revised, and fully abreast with the times.

J. V. B.

QUARTERLY SUMMARY

OF THE

PROGRESS OF MEDICAL SCIENCE.

ANATOMY.

UNDER THE CHARGE OF

GEORGE D. THANE, M.R.C.S. ENG.,

PROFESSOR OF ANATOMY AT UNIVERSITY COLLEGE, LONDON.

ON THE ABDUCTOR MINIMI DIGITI PEDIS, AND THE ABDUCTOR OSSIS METATARSII QUINTI MUSCLES.

WENZEL GRUBER found the abductor ossis metatarsi quinti in 9.25 per cent. of 400 feet, a frequency which is much below that recorded by Wood from the examination of a smaller number of specimens. Gruber makes a distinction, however, between this muscle and the insertion of a slip of the abductor minimi digiti into the fifth metatarsal bone; the latter occurred in 8 per cent. of 350 feet; in one instance the two existed together. A new variety of this muscle is described under the name of *abductor ossis metatarsi quinti circumflexus*, the whole or a part of the tendon winding from the plantar to the dorsal surface of the fifth metatarsal bone in front of the tuberosity, to be inserted into the base of the fourth and fifth metatarsals; it was found in 3.5 per cent. The abductor minimi digiti had a slip of origin from the tuberosity of the fifth metatarsal bone in 6 per cent. A bursa was present between the tendon of the abductor minimi digiti and the tuberosity of the fifth metatarsal in 2.5 per cent. The abductor ossis metatarsi quinti is seldom absent in mammals.—*Virchow's Archiv*, December, 1886.

ON THE OPHTHALMIC ARTERY.

F. MEYER was led to investigate the anatomy of the ophthalmic artery by the occurrence of a case of fatal hemorrhage after enucleation of the eyeball. In the orbit which had been the seat of operation, he found the ophthalmic trunk given off from the internal carotid artery and passing into the cavity by the inner end of the sphenoidal fissure, while the lachrymal and supra-orbital arteries arose together from the middle meningeal and entered the orbit through the outer part of the same aperture. The supraorbital artery anastomosed with the ophthalmic above the optic nerve. The ophthalmic artery was closely applied to the optic nerve, with which it had been divided.

The detailed arrangement in twenty dissections is given, and the general results of the investigation are as follow:

The number of the named branches, and the order in which they arise are subject to many variations, but the typical arrangement may be thus stated: (1) the central artery of the retina, arising in common with one of the ciliary trunks, more frequently the internal; (2) the external ciliary trunk; (3) the lachrymal artery; (4) a supero-external muscular branch; (5) the supraorbital, giving off the posterior ethmoidal; (6) an infero-internal muscular branch; (7) the anterior ethmoidal artery; (8) the terminal division into palpebral, frontal, and nasal. The posterior ethmoidal artery is sometimes wanting, and the supraorbital is often very small.

In addition to the branches usually described, small offsets are sent forward from the beginning of the ophthalmic artery, or from the internal carotid, to the sheath of the optic nerve; and these anastomose with other recurrent vaginal branches of the ophthalmic trunk; a similar anastomosis is formed by the small branches of the carotid and ophthalmic arteries through the inner end of the sphenoidal fissure.

Deviations from the usual condition in the origin and course of the artery are to be explained by the excessive development of a regular anastomotic channel. Thus, the artery (or an accessory source of supply) may arise from the internal carotid, and enter the orbit through the inner end of the sphenoidal fissure by the enlargement of the above mentioned anastomosis, or from the middle meningeal, infraorbital, or anterior deep temporal artery by means of the normal communication with those vessels.

The ophthalmic artery was found crossing beneath, instead of over the optic nerve in three of the twenty dissections, these numbers being identical with those obtained by Zuckerkandl. This condition may be due to an enlargement either of the anastomosis along the nerve, or of a communication between muscular branches of the trunk. In these cases the normal trunk may either disappear, or it may persist as an anastomotic loop above the nerve, which is then surrounded by an arterial ring.

In one instance the ophthalmic artery was seen passing inward above the superior oblique muscle.—*Morphologisches Jahrbuch*, December, 1886.

ON THE PRIMARY OPTIC CENTRES.

The late Bernhard von Gudden was the first to show, by means of degeneration experiments, that the inferior quadrigeminal and internal geniculate bodies do not give origin to optic nerve-fibres; and his conclusions, which have been confirmed by Fovel and von Monakow, are generally accepted, although they have been, so far as relates to the inferior quadrigeminal body, recently controverted by Bechterew. L. DARKSCHEWITSCH now goes further and states, as the result of histological research in the rabbit and dog, that not only do no optic fibres spring from the above mentioned nuclei, but that the same is the case with regard to the pulvinar of the optic thalamus and the external geniculate body. The atrophy of these parts after enucleation of the eyeball is explained as due to the degeneration of nerve-fibres which simply pass through them on their way to the surface. The optic fibres have therefore only one centre, namely, the superior quadrigeminal body, but they are

joined in the neighborhood of the external geniculate body by others which spring from the pineal gland and the habenular ganglion, and which appear from physiological experiments to be pupillary fibres. Charcot's hypothesis of a crossing of the optic fibres in the corpora quadrigemina finds no support. Darkschewitsch also finds that the upper quadrigeminal body alone is connected to the cerebral cortex by a distinct tract of fibres, and that no such tracts can be followed to the outer geniculate body or pulvinar.—*Archiv für Anatomie*, August, 1886.

ON THE MINUTE ANATOMY OF THE BRACHIAL PLEXUS.

W. P. HERRINGHAM gives (*Proc. Royal Society*, No. 243, 1886) the results of 55 dissections of the brachial plexus, 32 foetal and 23 adult. The sources of the several muscular and cutaneous branches are as follows: the numbers 5 to 8 indicating the corresponding cervical nerves, and 9 the first dorsal.

Posterior thoracic, 5, 6, and usually 7. Suprascapular, 5 and sometimes a small root from 6. Anterior thoracic, 6, 7, 8, and 9. Coraco-brachialis, 7, the rest of the musculo-cutaneous from 5 and 6.

Median, 6, 7, 8, and 9; 6 supplies pronator teres, flexor carpi radialis, superficial thenar muscles, and radial finger or fingers; 7 supplies flex. sublimis, occasionally ant. interosseous, palmar cutaneous, and the finger next to 6; 8 supplies flex. sublimis, ant. interosseous, and fingers internal to 7; 9 goes only to ant. interosseous.

Ulnar, 8 and 9; the forearm muscles are supplied by both, the hand muscles by 8, palmar cutaneous branches, 9; dorsal, 8. Internal cutaneous, large and small, 9, the large occasionally also 8.

Subscapularis, 5 and 6; teres major, 6 and often 7; latissimus dorsi, 7 and often 8. Circumflex, 5 and 6; deltoid from both; teres minor, 5 only; cutaneous branch, 5 or both. Musculo-spiral, 6, 7, and 8, sometimes also 5, rarely 9; triceps, 7 and 8, outer head sometimes 6 as well; internal cutaneous branch, 8; short external cutaneous, 6; long external cutaneous, 7; radial extensors, 6, or more frequently 7; radial nerve, 6, or 6 and 7; posterior interosseous, 7, sometimes also 8.

The following laws relating to nerve supply are also formulated:

I. Any given fibre may alter its position relative to the vertebral column, but will maintain its position relative to other fibres.

II. *a.* Of two muscles, or of two parts of a muscle, that which is nearer the head end of the body tends to be supplied by the higher, that which is nearer the tail end by the lower nerve.

b. Of two muscles, that which is nearer the long axis of the body tends to be supplied by the higher, that which is nearer the periphery by the lower nerve.

c. Of two muscles, that which is nearer the surface tends to be supplied by the higher, that which is further from it, by the lower nerve.

III. *a.* Of two spots on the skin, that which is nearer the preaxial border tends to be supplied by the higher nerve.

b. Of two spots in the preaxial area, the lower tends to be supplied by the lower nerve, and of two spots in the postaxial area, the lower tends to be supplied by the higher nerve.

PHYSIOLOGY.

UNDER THE CHARGE OF

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ELECTRIC STATE OF THE HEART ON VAGUS STIMULATION.

A. TALJANZEFF (Moscow) found in the frog and rabbit, with a modified Lippmann's capillary electrometer, that the heart gave no signs of change in its electric state during the stand-still produced by stimulation of the vagus, comparable with the electric changes characteristic of muscle contraction.—*Archiv Anat. und Physiol.—Physiol. Abthl.* Supplement Band, Dec. 1886.

ELECTRIC CHANGE IN THE HEART ACCOMPANYING STIMULATION OF THE VAGUS.

In support of his view that all tissues are innervated by antagonistic (anabolic and katabolic) nerves, DR. W. H. GASKELL brings forward the observation that stimulation of the vagus in the neck of the tortoise causes in an uninjured portion of a strip of the quiescent auricle, when connected with the rest of the animal by the coronary nerve alone, a decided increase of electric *positivity*, just as a contraction is accompanied by a decided increase of *negativity*.—*Journal of Physiology*, Nov. 1886.

RHYTHM OF VOLUNTARY MOVEMENT.

PROF. J. VON KRIES (Freiburg) made observations in control of the results obtained by Schäfer and Horsley (see last number of this journal, p. 217), and in the main confirms their views. He considers all voluntary contraction of muscle to be of a tetanic nature. Volition never works with a single but always with a series of excitations; the shortest movement not being accomplished without some four or five. The limits in the rate of stimulation are, however, very wide, since the rhythm of vibration is found to vary between eight and forty per second.—*Archiv f. Anat. und Physiol.—Physiol. Abthl.* Supplement Band, Dec. 1886.

REGENERATION OF SMOOTH MUSCLE.

DRS. H. STILLING and W. PFITZNER, doubting the accuracy of Jakimowitsch's researches on the frog and spotted salamander, investigated this question on the muscular wall of the stomach of the Triton tæniatus and conclude: 1 That organic muscle tissue can regenerate itself. 2. The regeneration takes place by a multiplication of the existing muscle-cells by division of the contractile substance. 3. This division consists of a thinning of the cell about the centre of its length after the nucleus had shown the various phenomena of karyokinesis.—*Arch. f. Microscopische Anat.*, Dec. 9, 1886.

PLETHYSMOGRAPHIC RESEARCH ON VASOMOTOR AGENCIES.

Regarding the temperature of a limb as an inadequate gauge of its vasomotor variations, PROF. H. P. BOWDITCH and his assistant, J. W. WARREN (Harvard Medical School), made a series of experiments by the plethysmographic method on the vasomotor changes in the hind limb of cats following injection of curara and stimulation of cut end of the sciatic nerve. The greater or less volume of the limb was taken to indicate a more or less dilated state of the bloodvessels.

Curara lessened the size of the limb (*i. e.*, was followed by local vasomotor constriction) if the nerve were cut. The opposite result followed if the sciatic nerve were intact. These facts may be explained by supposing that a general vaso-dilator effect was caused by the drug influencing the centre from which the sciatic was cut off.

Stimulation of the peripheral end of the cut sciatic nerve of the curarized animal was followed by one of three results, viz.:

1. Prompt contraction, followed by more lasting dilatation.
2. Prompt contraction without marked dilatation.
3. Slow dilatation not preceded by contraction.

Of these the first was the most frequent.

It thus appeared that stimulation produced two antagonistic effects upon the bloodvessels of the leg. The first of these, *constriction*, is well marked with rapid stimulation, while a slow rate of stimulation favors dilatation. Owing to the rate of development of the two effects, the antagonistic influences produce their results in succession.

When the nerve had been some four or five days cut, the constricting influence was destroyed and stimulation only caused dilatation, from which it appeared that as a nerve degenerates after section it loses its constricting earlier than its dilating power, or, in other words, vaso-constrictor fibres degenerate more rapidly than vaso-dilators.—*Journal of Physiology*, Nov. 1886.

PEPSINOGEN AND PEPSIN.

Confirming results obtained by the first author, Messrs. J. N. LANGLEY and J. S. EDKINS (Physiol. Lab., Cambridge) find that pepsin is rapidly destroyed by alkalies and alkaline salts. Strength of the alkali solution, suitable temperature, and long period of action, increase the destructive power, while the presence of proteids lessens the rate of destruction.

In the hungry animal the mucous membrane of the stomach contains no pepsin, but only pepsinogen, the forerunner of pepsin, because one per cent. of sodium carbonate destroys little of the efficacy of the watery extract of the fresh organ.

Pepsinogen is rapidly converted into pepsin in the presence of weak acid, but otherwise is fairly stable, and in glycerine extract may remain unchanged for years. The change from pepsinogen to pepsin takes place rapidly during digestion.

CO₂ destroys both pepsinogen and pepsin; the former more rapidly. They are also both destroyed by a temperature of 55°–57° C.—*Journal of Physiology*, November, 1886.

THE INFLUENCE OF VENOUS CONGESTION ON THE SECRETION OF URINE.

DR. JOSEF PANETH, working under Heidenhain, gives some evidence upon this subject, made so important by the causal relation of cardiac and renal disease. After a careful review of the literature of the subject, he describes his experiments in detail. These lead him to conclude that, besides giving rise to albuminuria, the least congestion of the renal veins, under all circumstances, is followed by a diminution in the amount of the secretion, and that an increase of the secretion of the kidney cannot follow venous congestion. From the fact that the injection of diuretic salts (he supposes by raising the blood-pressure in the glomerules) causes reappearance of the flow when it had ceased from venous congestion, the author concludes that Heidenhain's hypothesis as to the mechanism of the cessation of secretion is correct, viz., that it depends on the lessening of the rate of the blood stream in the Malpighian capsules, and not, as Ludwig supposed, on the mechanical compression of the canals by the congested state of the veins, which condition remains unaltered or is increased by the greater flow through the glomerules.—*Arch. f. Gesam. Physiol.*, December 10, 1886.

PERIODIC AND "LUXUS" BREATHING.

In an elaborate paper, illustrated with many tracings, PROF. ANGELO Mosso, of Turin, gives the results of research on the respiratory movements of man and animals. He points out that a periodicity in the respiratory rhythm is much more common than is generally supposed, and can be produced by ordinary sleep or the action of narcotics. Under ordinary circumstances, the respiratory movements are more extensive and rapid than required by the organism. This "luxus respiration" disappears at high altitudes when the air becomes thinner. When the degree of periodicity becomes more marked, the breathing may be called remittent or intermittent, as in the Cheyne-Stokes respiration. In a dog under the influence of chloral hydrate, the inhalation of oxygen had no effect on the duration of the periodic intervals of cessation of breathing. He considers the view that a continuous relationship between the chemistry and the mechanism of respiration must be abandoned. The different departments of respiratory motion, facial, thoracic, diaphragmatic, etc., are capable of independent action or variation. Although not quite independent, yet the mechanisms of respiratory movement are so far automatic as to be able to surpass the chemical requirements of the organism, the vitality of which is indicated by the activity of the regulating nervous centres. Thus when the excitability of the brain and spinal cord increases, a greater gas-interchange occurs in the lungs than is necessary for the activity of the body, and during sleep the motor mechanisms of respiration indulge in periodic rests, and nervous excitation is lessened without the result of any interference with the chemical changes in the tissues or blood. The periods of variation in the respiratory movements do not correspond with those in the bloodvessels. If a variation be caused during the regular breathing, it is followed by a series of successive variations occurring periodically.—*Archiv f. Anat. und Physiol.* Supplement Band, December, 1886.

INNERVATION OF RESPIRATORY MOVEMENTS.

In an exhaustive paper with extensive literary reference, DR. MAX MARCKWALD (Kreuznach) gives a number of original experiments, in which the movements of the diaphragm are graphically recorded by the direct application of the flattened end of a lever to the under surface of the muscle, through a small opening in the abdominal wall. Among the conclusions to be arrived at, may be mentioned the following:

No respiratory centres can be said to exist above the medulla oblongata, where an easily excited *inspiration-centre*, acting in normal breathing, and a more difficultly excited *expiration-centre*, acting in dyspnœa, are situated.

Automatically the centre can only give rise to respiratory spasms, regular and rhythmical breathing being reflex acts, excited by the tonic action of the vagi in quiet respiration.

Impulses from the higher centres can also reflexly excite regular respiratory movements controlling or compensating those produced by the vagus. When these impulses from the higher centres are partially in abeyance, while the action of the vagus is unimpaired, periodic breathing (Cheyne-Stokes) may appear. Impulses from the skin have probably little effect while the vagal and cerebral channels are intact; but when these are interfered with, the sensory nerves may excite a regular series of respiratory movements.

The afferent fibres of the fifth, superior laryngeal, olfactory and splanchnic nerves slow respiration, and may cause standstill in the position of expiration. The glossopharyngeal do not alter the rate, but can produce slow inhibition.

The normal excitation of the respiratory centre does not depend upon the stimulation of the blood—either its want of oxygen, or excess of carbonic acid—as regular movements continue for some time without circulation; nor can the mechanical theory—the excitation depending on the degree of distention of the lungs—be accepted, as rhythmical movements continue when the thorax is opened and the lungs excised.—*Zeitschrift f. Biologie*, N. F. Bd. v.

MATERIA MEDICA, THERAPEUTICS, AND PHARMACOLOGY.

UNDER THE CHARGE OF

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LOBELINE.

From advance sheets of the *Drugs and Medicines of North America*, for which we are indebted to Prof. Lloyd, we obtain the investigations of DR. BARTHOLOW on the actions and uses of lobeline—the alkaloid of *Lobelia inflata*. Several papers have appeared on the physiological actions of lobeline, but up to the present there have been published no reports on its clinical

uses. Lobelia, the crude drug, has been the subject of no little controversy, and much has been said of its practical applications, but wholly from the empirical standpoint.

Lobeline is a liquid alkaloid of a brownish-red color, and it has an acrid taste and a tobacco-like odor. The salts are crystalline, and are freely soluble. The preparation used by Dr. Bartholow in his physiological and clinical research was a solution of the hydrobromate, furnished him by Prof. Lloyd.

In general terms, lobeline is a paralyzer, causing death by failure of respiration. Small doses at first increase the irritability of the reflex centres, and the cutaneous and corneal reflex are considerably exaggerated. As the action proceeds the paralysis beginning at the periphery increases, until finally complete muscular resolution occurs. The end organs of the motor nerves are first affected, then the nerve trunk, and finally the cord; but the muscles preserve their contractility. The pneumogastric terminals are paralyzed, and the heart, after a brief slowing, increases in movement considerably. If the medulla be first divided, when the full effects of lobeline are obtained the heart is arrested in the diastole, its cavities distended. If now a faradic current is applied, the auricle will start in action, but only the basal portion of the heart, and the latter acts much more feebly than the former. As the effects of lobeline develop, and before full paralysis occurs, the vasomotor centre is stimulated somewhat, and the blood-pressure rises a little; but it subsequently declines. Lobeline does not paralyze the heart muscle, and death is due to respiratory failure.

As respects sensibility, there is no action, for the sense of pain is manifested until full paralysis occurs. Locally it has a benumbing effect on the mucous membrane, but this is due to physical conditions, and is not a special endowment of lobeline. Consciousness is preserved until carbonic acid narcosis ensues.

Lobeline appears to be too harsh and depressing to be utilized as an emetic. In the ordinary medicinal doses it does not usually nauseate. One subject, an epileptic, complained of nausea after several days use, but it seemed to be transient. Based on the physiological actions it was tried in various neuroses. As it is not depressing to the heart, it was used in some cases of cardiac asthma, when with difficult breathing there was a rather feeble state of the cardiac action. In this condition, and in pseudo-angina pectoris, it was found to be very useful. Asthma—the neurosis—has been the malady above all others in which lobelia has proved useful. The alkaloid seems to be superior to the crude drug.

It has also proved useful in coughs, especially when they are of a spasmodic character; and as they are necessarily reflex, an agent that lessens the activity of the reflex centres must do good to some extent. Lobeline appears to be an effective remedy as an expectorant so-called.

It has also been used with benefit in epilepsy, chorea, and the spasmodic neuroses generally; but a longer experience is necessary to determine its real value. It can be said only that thus far it promises well.

The dose of the salts of lobeline will vary from $\frac{1}{100}$ gr. to $\frac{1}{20}$ gr. It does not appear to be as actively toxic as nicotine.

CARBONIC ACID INHALATION AND RECTAL INJECTION.

One of the most remarkable revivals in a therapeutical method that has happened lately, is the administration of carbonic acid gas by inhalation and by rectal injection. The proposers and advocates of this practice apparently suppose it to be a new discovery, or, at least, a novel expedient. So far from being new, it is distinctly a revival of an old suggestion—for Priestly, in his treatise entitled *Experiences of Different Kinds of Air*, alludes to the use of carbonic acid gas by inhalation in phthisis, and Percival (1768), on the *Use of Fixed Air*, proposed its administration by rectal injection. In a recent paper (*Bull. Gén. de Thérap.*, January 15, 1887) DR. M. DUPONT advocates the method of inhalation as more efficient than the rectal injection. If sulphuretted hydrogen gas is to be administered, rectal injection may be necessary, for, as Bernard demonstrated, this gas, when thrown into the rectum, escapes by the lungs, and does not act on the nervous centres; but carbonic acid gas which is mixed with the former is the active agent, and, as Dr. Dupont shows, this is more conveniently, as it is more rationally, employed by inhalation, and the results are not less excellent.

Dr. Dupont has used about 150 litres in twenty-four hours. He finds that the gas is antiseptic, and hence is appropriate in the treatment of the septicæmia of tuberculosis; that it is anæsthetic, and hence quiets the cough, allays the irritability of the larynx, and favors sleep; that it lessens waste by checking oxidation, and thus lowers the temperature; and that it stimulates the digestive organs and increases the peristaltic movements of the stomach and intestines.

ALCOHOL IN ACUTE FEBRILE DISEASES.

In the course of his "Therapeutical Conferences," now publishing (*Bull. Gén. de Thérapeutique*, January 15, 1887), DUJARDIN-BEAUMETZ advocates the use of alcohol in accordance with the principles of the great English clinician, Dr. Todd. He observes that, although the first enthusiasm aroused by the theories and observations of Todd has somewhat subsided, there is a general recognition of the great advantages of the alcoholic medication. The indications for its use in fevers are the adynamic state, the extremes of life, and habitual use.

After careful study of the physiological action of alcohol, Dujardin-Beaumetz concludes that it acts in some respects as a tonic, as an aliment, and as an antipyretic—thus formulating an opinion by a combination of the various theories most entertained at the present time. It is an aliment because it undergoes in the organism a more or less complete combustion; it is an antipyretic because the oxidation of the alcohol takes place at the expense of the oxygen of the blood, and thus lessens the production of heat; and it is a tonic because it furnishes the nervous system the elements of force and power.

The principles and methods of Todd, so recently discussed and approved in France, are surely fallen into neglect—into positive oblivion, indeed, on this side of the ocean. They were warmly approved by a section of the medical profession twenty-five years ago, but now the actively stimulating treatment of febrile diseases is relegated to the domain of past errors.

HYPNONE.

In the *Archives de Neurologie* for January, 1887, *acetophenone* is the subject of a critical paper by MM. A. MAIRET et COMBEMALE, based on physiological and clinical researches. Under the name *hypnone*, by which it is now generally distinguished, and which was given it by Dujardin-Beaumetz and Bardet, who were the first to study its physiological actions (*Bull. Gén. de Thérap.*, Nov. 1885; also, *Ibid.*, January, 1887), it has been administered a good deal, but chiefly in France. Dujardin-Beaumetz and Bardet assigned the name *hypnone* because this word is significant of its most important property. Unfortunately, the new remedy, brought forward with no little *eclat*, has not confirmed the confident promises of its projectors. For the most part, it has proved to be inefficient, although not devoid of hypnotic action.

The researches of MM. Mairet et Combemale confirm the opinion of those who hold that *hypnone* is possessed of but feeble hypnotic property. They ascertained that the quantity required to produce sleep in animals is really toxic. Administered in toxic doses they say that it rapidly induces a comatose state which has nothing in common with natural sleep. It is, also, a cardiac and respiratory paralyzer, this effect coming on with the coma. Their clinical observations were made on twenty-two subjects of various mental disorders, the special conditions for which hypnone was prescribed being restlessness and insomnia. In only two cases was a hypnotic action obtained, and in these it was indirect; by allaying unrest and muscular agitation the disposition to sleep was favored.

The facts demonstrate, say they, that hypnone is not a hypnotic, and the physiological investigation gave negative results, as had been the experience of other investigators.

CLINICAL EXPERIMENTS WITH ANTIFEBRIN.

RIESE reports (*Centralblatt für die Therapie*, January, 1887) the results of the use by Professor Fürbringer of antifebrin. It was administered in 30 cases: 10 of acute rheumatism; 5 of typhoid; 2 of pleuritis; 4 of croupous pneumonia, and 9 of phthisis. At first the doses did not exceed 30 grains, but they were increased to 45, to 60, and in 1 case to 120 grains, without any toxic action of consequence. The date and degree of the decline in temperature were not uniform. As in the cases of acute rheumatism the temperature was only slightly elevated, the reduction effected by the remedy was inconsiderable. In typhoid, also, it influenced the fever but little, and in only one case was the diminution of fever maintained longer than the immediate action of the remedy. Very considerable variations were observed in the degree of antipyretic effect in different individuals, especially in the phthical cases.

The slowing of the pulse corresponds to the decline of temperature. An increased tension of the arteries was usually witnessed. The respiration was also slowed, and lessened in volume, and occasionally some cyanosis of the face and extremities was observed. It never induced dizziness and headache, and, unlike antipyrin, did not cause nausea and vomiting; but, in some instances, improved the appetite. Perspiration was a constant attendant on

the decline of temperature, and, when large doses had been administered, it was excessive. In three instances alarming chills accompanied the rise in temperature, and were followed by weakness.

As regards the results obtained from the use of antifebrin, it did not have a specific effect in any of the maladies, except in acute rheumatism. It neither shortened nor modified the violence of typhoid: the cases of pneumonia did no better than those under the expectant plan of treatment. The cases of rheumatism did well under it with one exception. After considerable doses the pain subsides in three days and disappears in five. It must be an exceptionally severe case if the pain has not disappeared by the fifth day. In four of the ten cases relapse occurred, but three of these required only one dose of forty-five grains. In all of these cases the remedy had been discontinued on the cessation of the pain, and the cure was effected with salicylate of sodium, but the patients experienced ringing in the ears, headache, and vertigo which they had escaped when taking antifebrin.

The author concludes that although antifebrin cannot fill the place occupied by salicylic acid in the treatment of acute rheumatism, it is quite possible in many cases to effect a cure with the former without the unpleasant effects produced by the latter remedy.

The effects of antifebrin have also been studied by LÉPINE (*Ibid.*), whose conclusions are as follows: In typhus the effects of antifebrin are similar to those of antipyrin. At the point of minimum temperature, antifebrin does not induce a collapse-like condition of depression, but rather increases the power of the pulse whilst it lessens the number of beats. In severe cases it may cause cyanosis, and lessen the urinary secretion.

Antifebrin is a nervine. The lancinating pains of the tabetic are always calmed as if by magic with one or two doses of eight grains each. It has also been used in neuralgia with success, and in a case of multiple sclerosis it lessened the trembling and improved the patient's strength.

INHALATION OF CARBOLIC ACID IN WHOOPING-COUGH.

PICK, in a late paper (*Deut. med. Wochenschrift*, No. 21, 1886), maintains that the inhalation of carbolic acid gives the best results in whooping-cough. The failures of this remedy which have been reported were due, for the most part, according to Fick, to too great dilution. By means of a special mask which he has made and figured in a paper published three years ago, he administers fifteen to twenty drops of the pure acid, on a roll of cotton, introduced into the mask. The inhalation is carried on for several hours every day, the cotton wad being renewed three times a day. No ill results have occurred, and the duration and violence of the disease notably lessened.

THE EFFECT OF FLUIDS ON FEBRILE HEAT.

PROF. GLAX has recently called attention (abstract in *Bull. Gén. de Thérap.*, Jan. 30, 1887) to the fact that drinking fluids increase the temperature of fevers. During fevers there is retention of liquids, and it is only when the temperature returns to the normal that they are evacuated in quantity. The rise of body-heat is in direct ratio to the accumulation of fluid in the organism,

and Prof. Glax has ascertained that the temperature is notably reduced by withholding liquids. He explains this by supposing that the dilatation of the vessels, which is an incident of the febrile process, permits the accumulation of water in the blood, and thus there is a more prolonged contact of the red globules with the tissues, increasing oxidation or combustion.

PHOSPHATE OF LIME IN THE TREATMENT OF THE SWEATING OF CONSUMPTION.

DR. REBORY, in his Thèse de Paris (*Revue de Thérapeutique*, February 1, 1887), maintains that phosphate of lime is the most efficient remedy we have to arrest the sweating of consumption. In many cases the beneficial effects are experienced on the day of its administration. It diminishes or arrests the sweats completely, often for a long time. The special advantages of the phosphate of lime are, that it is not a poison, is easy to administer, is well borne by the stomach, promotes nutrition, lessens the diarrhœa, and can be taken for a long time with decided benefit to the general health.

VASELINE FOR HYPODERMATIC INJECTIONS.

In a communication, which appears in the *Bul. Gén. de Thérap.* for Jan. 15, 1887, M. LE DR. MEUNIER, of Lyons, advocates the employment of vaseline as an antiseptic subcutaneous injection. After a course of experiments on animals, he ascertained that the method was perfectly adapted to the same mode of medication in man. Vaseline, he finds, diffuses readily through all the tissues, and the solutions made with it can be employed topically to the skin and mucous membrane, or be administered by the stomach. He insists that chemically pure vaseline be used in making the preparations. The following formulæ are proposed for hypodermatic use:

R.—Eucalyptol (pure) 3ss.
 Vaseline (chem. pure) 3ij.—M.

Fifteen grains to two drachms may be administered in twenty-four hours.

R.—Eucalyptol (pure) ℥20
 Iodoform gr. j.
 Vaseline (chem. pure) Div

The dose of this is the same as the preceding.

R.—Turpentine (pure, prepared according to the method of Berthellot) ℥j.
 Vaseline (pure) Div.

Of this, fifteen grains to two drachms may be given each day.

When tinctures of essential oils are to be administered, Dr. Meunier advises that, their purity being ascertained, they should be dissolved in pure vaseline, allowed to stand, and then filtered through two leaves of Swedish filtering paper. The author of these suggestions must refer to liquid vaseline.

ANTIPYRIN IN HEMICRANIA.

DR. UNGAR, in a paper which we find in the *Centralblatt für die gesammte Therapie*, January, 1887, proposes the use of antipyrin in hemicrania, this application of the remedy having been suggested by the similarity of its

actions to those of salicylic acid. In some cases, administered when the first prodromes of the attack manifested themselves, it had sufficed to prevent them. In other cases, given during the maximum suffering, it distinctly alleviated the distress. Some were greatly benefited by it who had exhausted all the known remedies previously. In some instances, however, the relief afforded by it in one attack was not experienced in another; and in other cases it was without any value as a remedy. The dose varies from fifteen to twenty grains according to individual susceptibility.

NITROGLYCERINE IN HEART DISEASES.

DR. L. V. HOLST (*St. Petersb. med. Wochenschrift*, 30, 31, 1886; quoted by *Centralblatt f. Gesam. Therapie*, January 7, 1887) publishes some clinical experiences in the use of nitroglycerine in neuroses of the heart, valvular lesions, pulmonary oedema, etc. He finds that this remedy is a nerveine, and one that powerfully affects the nervous apparatus of the heart. In cases of cardiac feebleness with little or no degenerative changes, the action of nitroglycerine was uniformly favorable. Cases of angina were greatly benefited, and sometimes cured. In all instances of cardiac failure, the organ being free from important degenerative changes, it should be administered instead of nerve and vascular stimulants, as camphor, musk, etc., which have hitherto been used. He mentions typhus and pneumonia, as maladies in which this practice is advisable. He does not regard nitroglycerine as a diuretic, although in many cases he has observed an astonishing flow of urine as a result of its action. This result, he thinks, is due to the vascular changes caused by it, for when the kidneys are alone diseased, it does not increase the flow of urine.

Dr. von Holst advises the use of the alcoholic solution—one per cent. The dose is not a fixed one, and must be varied according to the individual susceptibility, which is very different. Some patients are affected by three drops, others by six drops of the one per cent. solution, and hence it is necessary to begin with one drop and increase the dose until its effects are felt.

MEDICINE.

UNDER THE CHARGE OF

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INVESTIGATIONS CONCERNING ICTERUS.

F. MÜLLER contributes to the *Zeitsch. f. klin. Med.*, B. xii. H. 1 and 2, 45-114, the results of an elaborate research upon the disturbances occurring in the intestinal canal in icterus. His method consisted in administering nourishment whose quantity and composition had been accurately determined;

and in ascertaining by analysis of the feces, how much of each class of nutritive substances had been absorbed.

After detailing his experiments, with remarks upon each, case he gives the following *résumé* of his conclusions:

1. In case of obstruction to the entrance of bile into the intestine, the absorption of the starches does not suffer at all; that of the albuminoids is at most only slightly affected; that of the fats is very much interfered with. In total failure of bile, 55.2–78.5 per cent. of the fat contained in the nourishment ingested is passed with the feces; while in health only 6.9–10.5 per cent. thus appears.

2. In the absence of the pancreatic secretion from the intestine, the digestion and absorption of the amylacea are not at all disturbed; though it would seem that those of flesh are a little less complete. An increased amount of fat in the stools could not be detected; and it is doubtful whether steatorrhœa is a symptom of diseases of the pancreas.

3. In diseases of the absorbing apparatus of the intestine (tuberculosis; amyloid disease; disease of the mesenteric glands; enteritis) the absorption of fat suffers much more greatly than that of the other constituents of the nourishment; and the feces exhibit the macroscopic, microscopic, and chemical characteristics of the fatty stool.

4. In healthy persons, as well as in cases of icterus, when the pancreatic secretion has access to the intestine, the fat in the feces appears to be almost entirely decomposed (on the average 84.3 per cent.). In 3 cases, in which there was a closure of the pancreatic duct, or a degeneration of the gland, a much less degree of decomposition was recognizable (39.8 per cent.). It seems, therefore, that absence of the secretion of the pancreas from the intestine produces a *qualitative* and not a *quantitative* change in the fecal fat. Fresh pancreatic juice will disintegrate fat far more completely and rapidly than bacteria will do it.

5. The more complete the absorption of fat in the intestines, the higher is the melting point of the fat in the feces. Fats which melt easily are absorbed better than those of a higher melting point.

6. Needle-shaped fat-crystals in the feces are an indication that the absorption of fat has been interfered with. They occur in icterus, and in other diseases in which there has been imperfect digestion of fat. They consist of free fatty acids, and of lime and magnesia soaps.

7. In cases of simple icterus there is no pathological alteration in the albuminous constituents; and the condition of the neutral sulphur and of the compounds of the sulphur-acids does not differ from that in health.

CYCLIC ALBUMINURIA.

G. KLEMPERER (*Zeitsch. f. klin. Med.*, B. xi., H. 1 and 2, 168) reviews the cases which are, or should have been, reported under this title; adds one of his own, and appends the following conclusions:

Cyclic albuminuria presents characteristic pathological features. It attacks chiefly young persons, and especially males. The patients usually present some nervous (neurasthenic) symptoms; often are troubled by indigestion, and may be somewhat anæmic; but exhibit no signs of Bright's disease.

Indeed, all symptoms except the albuminuria may be absent. Albumen is never to be found in the nocturnal urine, and the degree of albuminuria varies at different hours during the day. These variations appear to obey a certain law, and to follow a definite order in each case; but the hour at which the highest degree of albuminuria is reached, and the cycle as a whole, is not the same in different individuals. The time at which food is taken, and the composition of the nourishment appear to have no effect on the albuminuria; but muscular exercise often, though not in every case, influences it decidedly, and great mental strain appears to have some effect. It is almost certainly diminished by improving the state of the general health. It is prone to disappear temporarily if the patient be confined to bed. Its course is chronic; it is the source of no danger to life. It does not become transformed into severe disease of the kidney, and it may finally greatly diminish or disappear entirely.

THE TREATMENT OF CHLOROSIS WITH SULPHUR.

According to SCHULZ and STRÜBING (*Deutsche med. Wochensch.*, No. 2, 1887, 24) three forms of chlorosis may be distinguished therapeutically: 1st, that which disappears on the simple treatment of an imperfect digestion; 2d, that for which the use of iron is necessary; 3d, that which is unaffected or made worse by treatment with iron. For this form the authors have employed sulphur, on the ground that it is one of the constituents of the tissue. They report a series of such cases treated in this way, and give the following generalizations of the results obtained:

1. In the cases of pure chlorosis in which iron was without effect, the general condition was greatly improved by the use of sulphur.
2. After sulphur had been given for a considerable time, the treatment with iron could be commenced and carried out with good results.
3. In those cases of chlorosis which were complicated by catarrhal or inflammatory conditions of the digestive tract, sulphur was not well borne.

ON LAVAGE OF THE STOMACH IN PERITONITIS.

Encouraged by Senator's employment of this method in peritonitis with excessive meteorism, LEWIN has used it in two instances with excellent results (*Berliner klin. Wochensch.*, 1886, No. 44, p. 763). Both were cases of acute peritonitis following operation for strangulated hernia. Lavage was performed three times daily, and followed by the administration of opium. Immediate relief was obtained, pain and eructation were lessened, and sleep procured. Opium had been previously employed without effect. The washing removed the continually accumulating grass-green masses, and diminished the meteorism.

ON THE CONDITION OF THE URINARY FERMENTS IN BRIGHT'S DISEASE.

It has been already proved that normal human urine contains two ferments which act respectively as do pepsin and trypsin. MYA and BELFANTI (*Centralbl. f. klin. Med.*, 1886, No. 42, 729) have studied the changes which these undergo in different diseases. They determined the amount of each ferment

present by allowing them to act conjointly for a certain length of time upon accurately weighed portions of fibrin. The fibrin was then removed from the urine; and with it, of course, the ferments with which it had combined. The digestion was then allowed to proceed in artificially prepared fluids suited for the purpose, the loss of weight of the fibrin estimated, and the quantity of each ferment then easily determined. A large number of cases of various diseases were examined, but no constant results obtained, except in Bright's disease. Of this affection twenty-eight cases were studied, and the ferment resembling trypsin was found to be *invariably absent*, while the uropepsin was usually present. In albuminuria not dependent upon disease of the kidney, urotrypsin always occurred. The writers are of the opinion that this failure of the urotrypsin cannot be due simply to the presence of albumen in the urine, but is directly dependent upon the condition of the kidney itself.

ON PAROXYSMAL HÆMOGLOBINURIA.

BRUZELIUS (*Nordiskt. Medicinskt Arkiv.*, 1886, xviii. 22, 1-37) reports three cases of this affection, which seems to be especially rare in Norway and Sweden, though uncommon everywhere. In each of the three patients attacks of hæmoglobinuria were caused solely by exposure to cold. In one patient chilliness, elevation of temperature, perspiration, urticaria, sacral pains, and icterus were seen as accompanying symptoms. Other observers have reported fatigue as a cause, and some claim that syphilis is the true agent in its production. Bruzelius is of the opinion that the disease is a disorder of the blood, in which the destruction of the corpuscles takes place in the organs of circulation, and not in the kidney only, as Rosenbach believes.

ON THE EXAMINATION OF DIABETIC URINE.

One of the difficulties in the determination of the presence of sugar in diabetic urine is the occurrence of bodies interfering with or responding to the tests for it. In some cases oxybutyric acid destroys the exactness of the quantitative estimation with the polariscope. Being a substance which deviates the polarized ray to the left, it thus neutralizes, to a certain extent, the property of right-sided deviation which grape sugar possesses. LEO (*Deutsche med. Wochensch.*, No. 49, 1886, 869) has recently discovered a substance belonging to the group called "reducing agents," on account of their power to reduce the metallic oxides in alkaline solution. This body is a carbohydrate, has the same empirical formula as grape sugar, dissolves CuO in the presence of alkali, and reduces it on boiling. It does not, however, undergo fermentation, and deviates the light to the left. Its reducing power is about one-half as great as that of grape sugar, and it is necessary to boil for some seconds before the Cu₂O is precipitated. Leo has found this body in three cases of diabetes, but absent in a great many. Its occurrence appears to have no special import, except that it often makes the amount of sugar as determined by the copper test appear much greater than it actually is. The author insists that some other test must be employed to obtain accuracy, and especially recommends that by fermentation.

ANTIFEBRIN IN TYPHOID FEVER.

GRUENEBERG (*Berlin. klin. Wochensch.*, 1886, No. 49, 849) reports his results from the use of antifebrin in numerous cases of typhoid fever. The antipyretic effect was all that was sought. By a dose of 4-8 grains the temperature was usually reduced 3-4½° F. It rose again within the next four hours, the rise being often preceded by a chill. No injurious action upon the intestinal tract was seen. Profuse sweating was very common, but the author has never observed cyanosis or reddening of the skin, as after antipyrin. There was also no sensation of burning, or nausea, or vomiting, as often occurs with the older antipyretic.

CALOMEL AS A DIURETIC IN DISEASES OF THE HEART.

The use of this agent as a diuretic has been known and forgotten. Recently it has been revived by Jendrassik and by Stiller; and MENDELSON (*Deutsche med. Wochenschrift*, 1886, No. 45, 796) now adds his experience confirming its value in cardiac dropsy. He found it very useful combined with digitalis, and even sometimes effective where the latter drug alone had totally failed. It was best given in doses of three grains three times a day. Diuresis was induced after forty-eight hours, and the administration of the drug was then stopped. Salivation was never produced. He can give no explanation of the manner of its action.

CLINICAL OBSERVATIONS ON ULCER AND ON CANCER OF THE STOMACH, AND ON GASTRIC HEMORRHAGE; WITH EXPERIMENTAL INVESTIGATIONS ON THE CONDITION OF BLOOD IN THE HUMAN STOMACH.

In consideration of this subject, KORCZYNSKI and JAWORSKI (*Deutsch. med. Wochensch.*, Nos. 47, 48, 49, 1886) detail the examination of 52 cases.

I. *The clinical examination of patients suffering from gastric ulcer.* The œsophageal sound was employed in all cases except where the diagnosis could not be questioned; and the function of the stomach tested in three ways:

1. Aspiration of the stomach after strict fasting. If there be nothing to aspirate, 100 c.cm. of distilled water are ingested immediately before the operation. The contents of the viscus are then examined chemically and microscopically.
2. The stomach, empty of food, is examined by the modified ice-water method with regard to its secretion of HCl.
3. The empty stomach is examined by the albumen method regarding its digestive capability and mechanism.

In case remnants of food from the previous day are found, the organ is thoroughly washed out. In this way the authors think the result of an examination is much more accurate than when the ordinary contents of the stomach are studied, no previous fasting having been enjoined. The presence of HCl was determined by the methyl-violet test, although more reliance was placed on the digestion of a known weight of albumen. The authors confirm the fact that the gastric juice, to be capable of digesting, *must* contain HCl as well as pepsin. In some cases it was necessary to examine the contents of the stomach obtained without previous fasting or lavage.

24 of the 52 cases suffered from gastric ulcer, and in 6 of these the evidences of hemorrhage were discovered solely by the internal examination of the stomach. These 6 are reported at length. In the other 18 the diagnosis rested upon (a) the statement of the patient that there had been black vomiting and stools followed by a feeling of weakness; (b) the long duration of the disease without outspoken cachexia; (c) local results of the pathological process (stenosis of the pylorus; dilatation). In all the cases the secretion was much increased, and a considerable amount of fluid could be withdrawn from the stomach after fasting. This always contained a comparatively large amount of free HCl—larger than in any other disease—even when no remnants were present. The acidity was especially high at the time of a hemorrhage. The mechanical emptying of the viscus was much delayed, and in many cases it was never found entirely empty of food. The excessive thirst and hunger, so often complained of, are due to the great acidity rather than to the ulcer itself. Peptone could be always detected by the CuSO_4 test.

Their treatment of *ulcer ventriculi* differed somewhat from that ordinarily advised. In case of a hemorrhage absolute rest in bed for the first two days was enjoined, and a small ice-bag placed over the stomach. Swallowing of ice was only permitted to quench thirst, as it increases the secretion of acid; powders of sod. borat. and ext. opii, with small quantities of Carlsbad water, were given. This diminished the acidity and increased the mechanical action of the stomach. No food or drink was allowed. During the second two days no more ice was given if the bleeding had stopped. The diet was now cautiously increased, but at once reduced if pain was produced; and great care was exercised for three weeks at least. A small amount of stimulant was permitted if there was much weakness. Where there had been no hemorrhage the method was the same, except the strict regimen of the first two days. If there was much dilatation, lavage was added to the means described.

II. *Clinical observation in carcinoma of the stomach.* 28 cases were subjected to an internal examination of the stomach; and in 5 of these, which they report in full, recently effused blood was discovered in this way. In the other 23 the correct diagnosis was evident, although no blood was found. Anæmia was present in nearly all the cases, but without the waxy yellow color so often seen in ulcer. In every instance digestion was retarded, and in many cases the stomach, even after fasting, was overfilled with fragments of food. The secretion examined in the manner described was almost always found to be of neutral or alkaline reaction, mucous in character, and diminished in amount. HCl could be detected in the secretion of only 2 patients; both under 30 years of age. Yet in some cases the copper reaction for peptone could be obtained. The authors think some other substance than peptone produced this result.

The symptomatic treatment of cancer employed by them consisted in the administration of HCl and morphia several times a day on an empty stomach, with acid foods and wine. If fermentation of the ingested food occurred, salicylate of soda and borate of soda were given. Lavage was performed from time to time in cases of dilatation.

Korczynski and Jaworski do not accept the view of Riegel, that the secretions of the cancer destroy the normal juices of the stomach, but rather believe that the absence of HCl, as seen in the mucous catarrh of old persons,

drunkards, and others, predisposes to the development of the neoplasm. On the other hand, excessive acidity often produces an ulcer by its action on the mucous membrane.

Their remaining conclusions regarding ulcer and cancer are largely expressed in a diagnostic table of symptoms.

Ulcer.

1. A high degree of an acid gastric catarrh.
2. Unusually large amount of HCl, and very energetic digestive power of the gastric juice.
3. Blackish-brown coffee-ground vomit, with a smell of peptonized blood, and with destruction of the red blood cells.
4. Appetite preserved, or abnormally increased.
5. Excessive thirst.
6. Burning, cutting, often pressing pain of great intensity.
7. Usually no palpable tumor.
8. Vomiting in most cases.

Carcinoma.

1. Very marked mucous catarrh, except in young persons.
2. Complete absence of HCl, and diminution of the formation of pepsin.
3. Light, chocolate-colored vomit, smelling of fatty acids; and with remnants of red blood cells.
4. Appetite much diminished.
5. Usually no thirst; often a desire for acids.
6. Dull, continuous pain, with a sense of pressure.
7. Usually a painful tumor to be felt.
8. Vomiting in one-half the cases.

III. *Results of experiments respecting the condition of the blood in the human stomach.* Korczynski and Jaworski have further made some careful studies upon the digestion of blood, both within the stomach and by the secretions freshly removed from it. They found that in digestion outside of the viscus the blood corpuscles preserved their shape for a long time, to a greater or less extent. When ingested, however, they lost their form, for some reason, with extraordinary rapidity. From extended investigation they draw conclusions which corroborate their views obtained from clinical study:

1. That dark-colored gastric contents are probably, but not always caused by the presence of blood.

2. Dark brown material, like coffee-grounds, and smelling of peptonized blood, indicates ulcer. A dirty-gray, or light chocolate-colored substance, with an odor of the fatty acids or vinegar, indicates carcinoma.

3. A red, or red-brown filtrate, perhaps containing red blood cells, points toward a recent hemorrhage.

4. Gastric contents containing blood, which give a filtrate strongly acid with HCl, and of energetic digestive power, are characteristic of ulcer, while a filtrate free from HCl, and not capable of digesting, is characteristic of carcinoma.

5. An effort to produce hæmin crystals must be made, or the iron test for blood employed in all cases where the microscopic examination does not render the diagnosis certain.

6. Hæmin crystals will form spontaneously after several days in matter from the stomach containing blood and HCl.

It must not be forgotten that small effusions of blood may be produced by other means, as from slight abrasions of the mucous membrane by the sound, or from capillary hemorrhages.

THE POISONOUSNESS OF CHOLERA BACILLI.

CANTANI, in considering this subject (*Deutsch. med. Wochensch.*, No. 45, 1886, 789), says that there are three possible means by which the cholera poison may produce death:

1. *Plomaine*. A ptomaine may be formed by the vegetative activity of the bacilli in the intestinal canal; and this may be taken up by the blood.
2. *Secretion*. A special poison may be secreted by the bacilli, and in like manner be absorbed by the blood.
3. *Digestion*. The bacilli themselves may act directly as the poisonous agent. In this case it is by their death and digestion in the alimentary canal, and by their being taken up by the blood, that they act injuriously on the system.

The author concludes from his experiments upon animals, that it is probably by the last of these methods that the bacilli kill.

The therapeutic indications are two:

1. To limit the increase of the bacilli in the intestinal canal.
2. To aid in the elimination of the poison from the blood.

To fulfil the first, Cantani recommends very large enemata (2-3 or more litres) of a solution of 3-10 grammes of tannic acid in 1½-2 litres of water, sterilized by boiling, and used hot. He employs a simple irrigating apparatus of his own device, elevated 2-4 metres above the patient. By this means he has been able slowly to pass the injection even as far as the stomach. Anti-peristalsis, excited by the presence of the injection, has greater effect than pressure in accomplishing the upward passage of the liquid. The therapeutic results obtained have been most gratifying, especially when the treatment was instituted early. That the tannic acid had something more than a simply astringent effect, the author proved by observing its action upon cultures of the bacilli, whose growth it seemed nearly or entirely to check.

The second indication is met very satisfactorily by the hypodermatic injection of ½-1 litre of a hot saline solution, containing 4 grammes of chloride of sodium and 3 grammes of carbonate of sodium to the litre of warm, sterilized water. This prevents thickening of the blood; and, at the same time, removes the cholera poison from it and from the tissues.

ON PRIMARY DEGENERATIVE NEURITIS.

KAST (*Deutsches Archiv f. k. Med.*, B. 40, H. 1, 41-62) reports four cases of this disease which add to our clinical and anatomical knowledge of its symptoms and peculiarities.

The first occurred in a girl, aged thirteen, just recovering from angina follicularis, and seemed to be an instance of systemic infection from it. The first symptom was a paresis of accommodation. The case was further characterized by a progressive ataxia of the upper, and later of the lower, extremities; disturbances of sensibility, with diminution and retardation of the perception of painful sensations; tearing pains at first, but later no subjective complaints; never any tenderness of the nerves on pressure; atrophic paralysis of the in-

terosseï and of the tongue; absence of the faradic, and great diminution of the galvanic electrical contractility; abolition of the tendon reflexes, and gradual development of bulbar symptoms. Nine months after the beginning of the disease the patient died of lobar pneumonia. The post-mortem examination revealed nothing amiss with the central nervous system, but a multiple degeneration of the cranial and spinal nerves.

The three other cases lack the confirmation of an autopsy, but exhibit the clinical symptoms of the disease in question.

The second case occurred in a habitual drinker, and began with optic neuritis. Then followed a feeling of exhaustion, weakness, and formication in the legs; atrophic paralysis of both lower and upper extremities, accompanied by an attack of delirium tremens; multiple swellings of the joints; violent tearing pains, and croupous pneumonia. There was also slight tenderness of the nerves on pressure, with irregularly distributed, complete or partial reaction of degeneration.

The third case was one of puerperal infection with septic endocarditis. Soon there appeared atrophic paralysis in the parts supplied by the ulnar and median nerves, with partial or complete reaction of degeneration, and violent pains in both arms. The nerve trunks were tender on pressure; there was anæsthesia of both hands, and temporary paræsthesia and weakness of the feet. Complete recovery followed.

The fourth case was one of severe neuritis following a subcutaneous injection of ether. Paralysis of the radial nerve, and complete reaction of degeneration followed. After several months recovery took place. A discussion of the symptoms accompanies the report of each case.

CONCERNING A NEW MICROCOCCUS—THE PATHOGENIC AGENT IN INFECTIOUS TUMORS.

Under this title MANFREDI (*Fortsch. d. Med.*, B. 4, No. 22, 713-733) publishes an elaborate paper accompanied by colored plates. The micrococcus in question was found, accompanying that of Friedländer, in the sputum of patients dying of pneumonia after measles. He names it "the micrococcus of progressive lymphoma in animals." He then describes its form and its method of growth upon culture media. It was found to be exceedingly infectious to dogs, rabbits, guinea-pigs, and mice, and this infectious nature seemed to be extraordinarily persistent. The inoculated animals died after seven to twelve days, and exhibited enormous swelling of the spleen and liver, with a deposition in them, and in the lungs, lymphatic glands, and elsewhere, of gray or grayish-yellow nodules. These were composed of granulation-tissue, and belonged to the type of granuloma or infectious granulating tumors. With this were combined the characteristic signs of more or less pneumonia, even when the inoculation had been made in the subcutaneous connective tissue. The organism appeared to diffuse itself by means of the lymphatic system.

ON CHANGES IN THE PORTAL CIRCULATION CAUSED BY OBSTRUCTION TO THE DISCHARGE OF BILE.

In the *Deutsches Archives f. k. Med.*, B. 40, H. 1, 83-93, MARAGLIANO reports five cases illustrating the simultaneous and proportionate development

of icterus and enlargement of the spleen, and in which the latter disappeared as the former diminished. There being no other assignable cause for the splenic enlargement, the author believes it must be due to passive congestion; and, after advancing several arguments in support of this opinion, he concludes:

1. That the pressure of the overfilled biliary vessels upon the portal capillaries within the liver hinders, in a purely mechanical way, the discharge of blood from the portal system.

2. That symptoms of portal congestion, such as enlargement of the spleen and ascites, can be occasioned by this obstruction to the emptying of the portal veins.

3. That in catarrhal icterus, and in the icterus of engorgement in general, and especially in the hypertrophic form of interstitial hepatitis, the splenic swelling can be produced in the manner described.

THE CLINICAL VALUE OF URIC ACID SEDIMENT IN THE URINE.

From 3287 examinations of the urine of 272 cases, made with reference to the occurrence in it of uric acid, and its connection with albuminuria, MYGGE (*Nordiskt Medicinskt Arkiv*, 1886, xviii. 33, 1-17) found that no free acid occurred in 2786 examinations of 127 cases. Only 59 patients (262 examinations) exhibited uric acid abundantly at times, and in but 16 of these did its occurrence persist during a week or month.

The sediment was most often found in rheumatic affections and in pneumonia. In quite a number of cases lithæmia was seen coincident with albuminuria. Frequently, too, uric acid appeared as an acute albuminuria ceased; and, in many other lithæmic cases, microscopical examination revealed the presence of tube-casts and of renal epithelium. The author is convinced that there is a very frequent, if not a constant, relation existing between renal affections and the persistent deposition of uric acid in the urine. He is, however, unable to explain the nature of this relation. The albumen may be produced, in some cases, by the prolonged action of the highly acid urine upon the tubules; or in others the precipitation of uric acid may be induced by the morphological elements already existing in the urine coming from kidneys already diseased. Uric acid sediment also seems to bear some relation to the desquamation of vesical epithelium, and to certain forms of incontinence of urine.

THE FUTILITY OF THE SUBLIMATE TREATMENT OF TYPHOID FEVER.

GLÄSER (*Deutsches Archiv f. klin. Med.*, Bd. 40, H. 1, 31-41) contributes his experience, which is diametrically opposed to that of Greiffenberger. He gives the notes of twenty-three cases treated with sublimate, and the temperature-curve and pulse-curve of each. The quantity of the drug employed was about 0.3 grm. in divided doses during the twenty-four hours. He thinks it can have no possible action in destroying the bacillus, since it reaches in the blood a dilution of at least 1 in 104,000 in a man of 130 pounds weight. It is also rapidly eliminated from the system, and can therefore have no cumulative action. Gläser's conclusions from his case records are:

That by the use of sublimate the mortality of typhoid is not diminished; the temperature does not return any sooner to normal; the tongue is not made moist: the eruption of roscola not prevented or removed; the general condition of the patient not improved; and the duration of the disease or the liability to relapse not lessened. Thus, of all the claims of Greiffenberger, only that of the harmlessness of this plan of treatment can be admitted.

ON THE INFLUENCE OF VENOUS STASIS ON THE URINE.

Paneth has found that venous engorgement, even of moderate degree, diminishes the amount of urine, and that the administration of some diuretic (saltpetre) increases the secretion, in spite of the congestion. SENATOR and MUNK (*Centralbl. f. d. med. Wissensch.*, No. 3, 1887, 33) have studied the subject more carefully, and, while confirming both points, add considerably to the extent of Paneth's observations. They find, namely, that in venous stasis the amount of urine is always lessened, and the per cent. of urea very much diminished. On the other hand, the per cent. of chloride of sodium is not notably decreased, while that of albumen is constantly increased. This condition of the secretion of albumen is undoubtedly an indication that under the influence of the passive congestion the function of the kidney is interfered with, while the behavior of the urea proves that it is the *specific secretion* which is especially injured. The fact that the sodium chloride is not affected shows that this salt is not eliminated by a specific glandular secretion. The production, too, of the water of the urine cannot be called purely the act of secretion by a gland.

CEPHALALGIA PHARYNGO-TYMPANICA.

Under this title, LEGAL (*Deutsch. Archiv f. klin. Med.*, B. 14, H. 2, 201-217) reports ten cases of a temporo-occipital headache, etiologically connected with affections of the pharynx or ear. It is characterized by more or less violent paroxysmal pain occurring in the region supplied by the terminal branches of the auriculo-temporal and great occipital nerves; is accompanied by disturbances of sensation in this region, and by tenderness of the nerve trunks on pressure; and is relieved by proper treatment of the coexisting catarrh of the pharynx or middle ear. The pain is described as pulling, tearing, shooting, etc., and between the paroxysms there may be a continuous, dull, painful sensation on the affected side of the head. Bodily exertion, coughing, straining at stool, often increase this feeling. In some cases the patient was unable to bear with comfort the pressure of the lightest hat, and the jarring of his footsteps was painful to him. If attacks came at night, the sleep was disturbed. The left temporal region is the favorite seat of the pain. Hyperalgesia is commonly present. The presence of sensitive points is an additional proof that the affection is of a neuralgic nature. The occipital neuralgia appears to be especially connected with the pharynx, while the temporal pain is more nearly related to some disease of the middle ear. This is usually some chronic, catarrhal trouble, producing symptoms so slight that they are generally overlooked. Yet Legal found that local treatment appropriate for the catarrh of the pharynx and middle ear often cures the headache

in a very short time, and this without any anti-neuralgic or tonic treatment. The author thinks it possible that the violent, almost neuralgic headache sometimes accompanying various acute diseases is due to the affection of the mucous membrane which often coexists. He cannot explain in what way the neuralgia is connected with the pharyngo-tympanic catarrh.

ON THE SIGNIFICANCE AND DETERMINATION OF GLOBULIN IN THE URINE.

R. MAGUIRE (*Lancet*, June 5, and September 18, 1886) discusses the varieties of albumins occurring in the urine in cases of albuminuria, and suggests that an investigation to determine the presence of different kinds, as well as their relative quantities, may lead, perhaps, to practical information, important for diagnostic and prognostic purposes.

The presence of globulin and its proportion to the quantity of serum-albumin has especially engaged his attention. Ordinarily, it seems, both are present in the urine of nephritis, the serum-albumin preponderating. In some cases, however, the globulin is present in larger quantities than ordinary, while, in some cases of what appeared to be functional albuminuria, globulin alone was found. Thus, in four observations on what seemed a case of cyclic albuminuria, as well as in a case of puerperal albuminuria in which the albumin was rapidly disappearing spontaneously, globulin alone was found. Thus a possible common origin for these two conditions is suggested.

For separating the globulin from the serum-albumin he adopts the method of saturating the previously neutralized urine with magnesian sulphate. This neutralization is important, for, if the urine be acid, the serum-albumin will be precipitated as well. The globulin is precipitated in an uncoagulated form, it being subsequently freely soluble in water.

In experiments on artificial ox-blood serum, made by dissolving dried blood-albumin in water, HOFMEISTER and KAUDER (*Arch. f. exp. Path.*, vol. xx. p. 411) found that when ammonium sulphate was added till it formed from 24.1 per cent. to 33.6 per cent. globulin alone was precipitated. When the concentration exceeded 33.6 per cent. the precipitation of serum-albumin began, and when it reached 47.2 per cent. the precipitation of the latter became complete. (A cold saturated solution of ammonium sulphate contains 52.4 per cent. of the salt.)

This method of fractional precipitation has been applied by HOFMEISTER and POHL (*Arch. f. exp. Path.*, vol. xx. p. 426) to the separation of the albumins of the urine. It was found that if to a given bulk of urine previously made alkaline by ammonium hydrate, an equal quantity of a saturated solution of ammonium sulphate were added, all the globulin would be precipitated. This, after being allowed to settle for one hour, was filtered, washed with a half-saturated solution of the ammonium sulphate, then with boiling water, and subsequently with alcohol and ether, dried at 110° C., and afterward weighed and ignited.

For a rapid qualitative test they recommend adding the ammonium hydrate to the urine, filtering off the resulting turbidity, and then adding an equal volume of a saturated ammonium sulphate solution.

SURGERY.

 UNDER THE CHARGE OF

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 RECENT SURGICAL LITERATURE.

The last volume of the *Dictionnaire Encyclopédique des Sciences Médicales* runs from "Peric" to "Perit," and contains the following papers of surgical interest: The article "Perinée," by M. KIRMISSON, is complete and well written, and especially valuable for the full account it gives of the various operations for the relief of rupture of the perineum. The article "Perioste" is one of the most important that has appeared in this great work. The anatomy of the periosteum is dealt with by M. RETTERER, and is exhaustive and original. M. HEYDENREICH, under the title of "the pathology of the periosteum," discusses the part played by this membrane in bone affections, scrofulous gumma, and the whole subject of the regeneration of bone. The elaborate treatise on periostitis is from the able pen of M. Kirmisson.

The next article is on the peritoneum. The anatomy, histology, physiology, and development of the peritoneum are dealt with by M. BARABAN. The monograph will become classical. It is complete and up to date, and abounds with original matter. The subject of peritonitis is only commenced. The treatise will probably occupy the greater part of the next volume.

Éléments de Pathologie Chirurgicale Générale, by PROF. BAUDRY (Paris, 1886, vol. i.). This is a small work, the precise object of which is not very evident. The present volume deals with acute and chronic inflammation, hemorrhage, thrombosis, gangrene, ulceration, and injuries in general. The matter is well arranged. Considerable space is devoted to theoretical subjects, but the book as a whole shows no evidence of original work.

Handbuch der Chirurgischen Technik, by DR. MOSETIG-MOORHOF (Leipzig, 1886). This is the first part of what promises to be a very complete treatise upon operative surgery. The first section deals with narcosis and local anæsthesia. The second embraces the whole subject of the general treatment of wounds. This chapter, written in a liberal spirit, provides an excellent review of the present position of this branch of practice. The third section is concerned with what are termed elementary operations, such as arrest of bleeding, use of écraseur, bloodless methods of operating, etc. The volume concludes with general operations upon the various tissues. The work is exhaustive and elaborate, and well illustrated, and if the remaining volumes are written with the same care and ability as the present one the book will probably prove to be the best treatise on operative surgery in recent times.

Die Heilstätten für scrophulöse Kinder, by DR. SCHEIMPFLUG. This work deals with the various establishments for the treatment of scrofulous children in Europe. At least two works upon the same subject have been published

within the last eighteen months in France. The present volume has the advantage of brevity. It is at the same time very complete and well up to date. It embraces England, France, Germany, Austria, Italy, Belgium, Holland, Russia, and Denmark. It is illustrated by a few good plates.

Traité de Chirurgie Clinique, by PROF. TILLAUX (Paris, 1886, vol. i.). This is the first volume of a work by the celebrated author of *Anatomie Topographique*. It is very disappointing. The present volume deals with the head only. Within 386 small pages the author discusses injuries and diseases of the head, eye, ear, nose, mouth, and tongue. The various subjects are, of necessity, treated in the most scanty manner. No illustrative cases are given, and in the English sense the work would not merit the title of "Clinical Surgery." It is a systematic treatise on surgery in outline. The illustrations are few and conspicuously poor. The work will not add to its author's reputation.

L'Hermaphrodisme, by DR. DEBIERRE (Paris, 1886). This small work aims at giving a complete account of hermaphroditism. The subject has always attracted more interest in France than in England. The best known cases are described, and are represented by very good woodcuts. It cannot be said that the volume adds to our present knowledge, but the completeness of its scope is no small point in its favor.

Traité des Manœuvres d'Ambulance, by DR. A. ROBERT (Paris, 1886). This is a large work of 630 pages that should exhaust the subject of ambulance. It is illustrated by a vast number of original and most excellent woodcuts.

It gives a complete account of the medical department of the army, of the equipment of the various field hospitals, and of the duties of the different medical officers. Another chapter concerns the general arrangements in the field. A considerable part of the book is devoted to the first treatment of the wounded and the subject of transport. The author appears to have made himself acquainted with every form of ambulance, wagon, and stretcher, and to have exhausted all possible forms of transport, good, bad, and indifferent. A long account is also furnished of the operating chest and its contents. The book is admirably arranged, and gotten up with unusual care.

Traitement chirurgical de la Péritonite, by DR. TRUC (Paris, 1886). The leading point of this little monograph is rendered evident by the motto on its title page, "Ubi pus ibi evacua." The author gives an account of the various forms of peritonitis, and then of the treatment by laparotomy, evacuation of the effusion, washing out of the cavity, and drainage. He gives a number of illustrative cases. The work does not aim at originality. The author's conclusions have long been accepted by the majority of surgeons. As a literary production the book deserves high praise. Perhaps its most valuable feature is an exhaustive bibliography of "the surgical treatment of peritonitis."

Traité des Kys'es Congenitiaux, by PROF. LANNELONGUE (Paris, 1886). A valuable and exhaustive monograph upon congenital cysts. The first part deals with dermoid cysts, the second with mucoid, and the third with serous cysts. The mucoid tumors are regarded as belonging to the dermoid series.

The anatomy of the serous cysts is very fully given. The author believes that some are altered angioma, while the majority are of lymphatic origin. The fourth section of the work deals with cysts not included under the above headings—*e. g.*, hydronephrosis, sacro-coccygeal tumors, etc.

Des Luxations Pathologiques, by MM. FORGUE and MAUBRAC (Paris, 1886). This laborious work discusses the whole subject of pathological dislocations, their etiology, pathology, and anatomy. The mechanical causes that produce deformity on the various points are fully considered. The authors have produced a very complex classification of pathological luxations, that will probably not commend itself either to pathologists or to surgeons. The work is exhaustive and up to date, but adds little to our present knowledge.

Krankheiten der Nase, ihren Nebenhölen und des Rachens, by DR. G. SCHEFF (Berlin, 1886). This is an ambitious work upon diseases of the nose and pharynx. It aims at being complete, and professes to cover the whole subject of pathology, diagnosis, and treatment. The author attempts—with poor success—to consider, apart from one another, the affections of the nose and of the pharynx. The work is of unequal merit, the best and most exhaustive chapters—and at the same time the least useful—are upon the subject of deformities of the nose and rhinoplasty.

Die Lehre von der Brucheinklemmung, by DR. F. REICHEL (Stuttgart, 1886). A very valuable and original contribution to the subject of intestinal obstruction. The first part deals with an analysis of 160 cases of strangulated hernia. The second part enters fully into the whole of the vexed question of the mechanical causes of obstruction of the lumen of the strangulated bowel. The paper is an elaborate one, illustrated by ingenious original experiments.

Über die Behandlungsmethode der Prostatitis mit besonderer Berücksichtigung der Prostata Hypertrophie, by L. FISCHER (Munich, 1886). The work commences with an account of the various forms of prostatitis, their pathology, diagnosis, and treatment. It then considers prostatic abscess, prostatic hypertrophy, retention from prostatic enlargement, and kindred subjects. A very good account is furnished of these affections, and although the monograph cannot lay claim to much originality, it may be regarded as one of the best works we possess upon the surgery of the prostatic region.

TETANUS.

The nature of tetanus was one of the subjects chosen for discussion at the recent Congrès Français de Chirurgie (*Revue de Chirurgie*, No. 11, 1886). The following is a brief account of the conclusions of the various speakers:

M. VASLIN gave an account of 17 cases with 1 recovery. He regarded the disease as of nerve origin ("*une surexcitation nerveuse*"). He had injected the blood and urine of patients who had died of tetanus into animals, but no result had followed. He advised perfect isolation and the use of chloral and morphia in large doses.

M. BALESTRERI also considered the disease to be a pure neurosis. He uses tartar emetic, beginning with a dose of five centigrammes (about one

grain) and increasing the amount gradually until the patient is taking thirty to forty centigrammes every day. 3 cases were treated by this drug and all recovered; 17 cases were treated with chloral and only 6 recovered.

M. THIRIAR would class tetanus with the infective diseases. He gave details of 4 cases to support his view.

M. MANORY believed the disease to be contagious, but also considered that cold and other climacteric changes were concerned in the etiology.

M. DOYEN considered tetanus to be a form of septicæmia. In fatal cases he had found micrococci in the brain, the liver, and the blood. He considered that they had spread from the wound, chiefly along the sheaths of the lymph vessels and the nerves.

PROF. VERNEUIL argued the hypothesis that the disease has an animal origin and is derived from the horse. He believed that tetanus is always a specific infectious malady, probably conveyed from one subject to another by a specific microbe. He gave facts to support his view that the disease is derived from horses, stating that tetanus is peculiarly frequent in those who attend horses, and most apt to occur after horse-bites. Direct infection from tetanic horses has been proved.

M. LARGER gave illustrations to prove that tetanus is an infectious and contagious disease; while DR. BLANC (a physician from Bombay) considered that the disease is, like cholera, greatly influenced by seasons and climate. He regarded cold and wet as probable factors. He considered that a specific germ may exist, and that infection is conveyed, as in cholera, probably through the water.

DR. HILLER (*Centralblatt für Chirurgie*, 1886, No. 48) claims that there is a certain resemblance between tetanus and heat apoplexy. Both affections are marked by high temperature, and, indeed, some of the highest recorded temperatures have been met with in these two disorders. He considers that the great body heat is due to the muscular contractions, and that the essential feature in treatment should be the withdrawal of some of that heat. He advises that tetanus be treated by cool baths and by antipyrin or thallin in large and repeated doses. The action of the skin should be increased by pilocarpin.

THE TREATMENT OF MALIGNANT PUSTULE.

DR. INDUTNJII (*Russkaja Medizina*, 1886, No. 20) strongly recommends the treatment introduced in 1884 by Scharnowskji. This consists in the hypodermatic injection of a two per cent. solution of carbolic acid. The injections are made from two to three times daily. The sore is covered with a compress of carbolic lotion, and quinine is administered internally. Of six cases treated in this manner, only one died. In this instance the pustule was situated on the lip, and the treatment was commenced too late. The use of a hypodermatic injection of a warm one per cent. solution of salicylic acid has also been attended with good results.

DR. SLESSAREWSKJI (*Ibid.*, No. 30) treats malignant pustule with corrosive sublimate. His paper deals with 63 cases. Of this number, only 2 died. One of the fatal cases did not come under treatment until the seventh day, and the other died on the sixth day of the disease with severe gastro-intestinal catarrh. Of the 61 cases that recovered, 1 was seen on the first day, and 1

on the fifth, 22 came under notice on the second day, 30 on the third day, and 7 on the fourth day.

The pustule was seated upon the face in 6 cases, upon the neck in 21, and upon other parts of the body in 34.

44 of the cases were treated in the following manner: The surface of the pustule is cut away with a scalpel and the raw area is then dusted with corrosive sublimate in powder. Quinine is given internally. A slough forms at the site of the pustule which separates in about ten days. In no instance were symptoms of poisoning produced.

In 11 instances salicylic acid in powder was applied in the same manner, but it is apparently less efficacious.

In 5 cases the pustule was destroyed by the actual cautery, and in one example the carbolic acid treatment (Scharnowskji) was employed.

DRS. WORONZOFF, WINOGRADOV, and KOLESNIKOFF (*Ibid.*, No. 32) have performed a series of elaborate experiments upon animals with a view of ascertaining the best means of destroying the virus of malignant pustule.

They treated the fresh blood and portions of the skin of animals that had died of malignant pustule, with various disinfecting solutions, and then inoculated healthy animals from the tissues so treated. 0.2 per cent. solution of corrosive sublimate, 5 per cent. solution of carbolic acid, and 4 per cent. solution of salicylic acid, rendered the diseased tissues harmless in a comparatively short time. Chlorate of lime and solutions of tannin and chloral hydrate were useless. Of the disinfectants used, corrosive sublimate was the most rapid and the most complete in its action.

CHIAN TURPENTINE IN CANCER.

DR. JOHN CLAY (*Lancet*, 1886, vol. ii. p. 720) states that since his first communication on this subject (six years ago) he has treated and cured a number of cases of epithelial cancer by means of Chian turpentine. He gives three typical examples: 1. Epithelioma of tongue. Male, aged fifty-nine. Ulcer of four months duration, the size of a sixpenny piece, and surrounded by much induration. One enlarged submaxillary gland the size of a pullet's egg. Movements of tongue limited. No history of syphilis. Treatment: Chian turpentine mixture (Southall's), 8 ounces; resorcin, 2 drachms. Two teaspoonfuls three times daily. The ulcer to be painted on alternate days respectively with chromic acid solution (10 grains to the ounce), and solution of perchloride of mercury (one grain to the ounce). In three months the gland had disappeared, and the ulcer was healed. A new growth appeared on the opposite side of the tongue, associated with another enlarged gland. These both disappeared under continued treatment. In connection with this case, two questions suggest themselves. Are surgeons familiar with bilateral development of epithelioma in the tongue? What interpretation is to be put upon the fact that the second cancer developed when the patient was well under the influence of the drug?

2. Epithelioma of upper lip. Female, aged fifty-two. No history of syphilis. A fungating indurated growth of irregular outline had occupied the whole of the upper lip and involved the lower portion of the left ala nasi; duration of disease not mentioned. A piece examined under the microscope in the fresh

state showed epithelial nests. At the end of thirteen weeks the mass sloughed out or "separated;" a good cicatrix followed. The microscopic examination in this case is unsatisfactory. The comparative rarity of epithelioma of the lip—and especially of the upper lip—in females must be noted, and also the peculiar extension of the disease in this instance. There is no mention of gland enlargement.

3. Epithelioma of the os and cervix uteri. Age, fifty-four. Watery and sanguineous discharges for several weeks. Emaciated and cachectic. The epitheliomatous growth was the size of a hen's egg. After seven weeks of treatment, the growth had almost disappeared. A complete recovery resulted.

MR. BURY (*Ibid.*, p. 895) reports a case of cancer of the os uteri (in a patient aged forty-nine) cured by the use of Chian turpentine. Symptoms had existed for six months. He also records an instance of long-standing cancer of the breast that underwent improvement while it was being administered.

EPIHEMERAL GLYCOSURIA IN SURGICAL PRACTICE.

DR. REDARD has published a paper upon this subject in the *Revue de Chirurgie*, 1886, Nos. 9 and 10, the following excellent abstract of which appears in the *London Medical Record* for December, 1886.

Ephemeral glycosuria frequently occurs in surgical practice. It is in some instances accompanied by ephemeral albuminuria, and very often the albumen is replaced by sugar, and *vice versâ*. It is not rare to find that sugar appears in the urine several times in the course of the affection. From the author's experience, ephemeral glycosuria is almost always accompanied by transient polyuria and an increase in the quantity of urea. The quantity of sugar which is proportionate to the gravity of the case varies to a considerable extent in different cases. The surgical affections in which this complication has been observed are extremely varied. It was often noted after slight injuries and subcutaneous fractures, but occurs, the author states, much more frequently and, indeed, almost constantly during phlegmonous and gangrenous affections, anthrax, lymphangitis, and erysipelas, and presents itself in a most marked degree in a great number of cases of suppuration just at the time of the formation of an abscess. The author's cases show that there exists a decided relation between the formation of the pus and the appearance of the glycosuria. In nearly all the cases of phlegmon, erysipelas, and septicæmia observed by the author, sugar appeared in the urine just as the temperature of the body was suddenly elevated. The affections in which ephemeral glycosuria has been most frequently observed are those of a septicæmic character. It is held that in the great majority of cases reported in this paper, the condition of the urine was a true ephemeral glycosuria, analogous to the ephemeral albuminuria recently observed in the course of certain medical affections. There was no history of diabetes. Of many patients who were observed from time to time after cure of the surgical affections, not one presented glycosuria or any other sign of diabetes. It is necessary, however, in order to distinguish ephemeral glycosuria from true diabetes, to continue for some time the daily examination of the urine. In attempting to account for the appearance of sugar in the urine at certain times in the course of some surgical affections, the author suggests that the impression produced at the periphery by a cuta-

neous inflammation, or some other local morbid condition, might be transmitted to the vasomotor fibres contained in the splanchnic nerves and so cause hyperæmia of certain organs, especially the liver and lungs, and accelerate the transformation of glycogen into sugar, thus giving rise to glycosuria. By this theory might be explained also the instances of ephemeral glycosuria and albuminuria that have been observed in the course of some medical affections and after irritation of the skin. Glycosuria, when occurring at an advanced stage of certain surgical affections in association with congestion of the lungs, might be considered as asphyxic and due to the phenomena of insufficiency of oxygenation of the blood. The author would rather admit that the asphyxic blood acts as an irritant and excites the liver to discharge a larger quantity of sugar into the circulation. This irritation may act directly on the liver, but more likely is transmitted by the great sympathetic of the vagi nerves from the cerebro-spinal nervous system. In concluding his paper the author states that these numerous theories might explain ephemeral glycosuria, but that none of them are entirely satisfactory and applicable to every case. Too much at present remains unknown for a complete solution of the problem.

THE TREATMENT OF COLD ABSCESS.

DR. ANDRASSY (*Brun's Beiträge zur klinische Chirurgie*, Bd. ii. S. 311) advises the treatment of cold abscess by means of injections of iodoform. He injects the following mixture into the abscess cavity: Iodoform 10 parts, glycerine 50 parts, water 50 parts. He makes two or three injections, as a rule, at intervals of about fourteen days, and obtains a cure by this means in from four to five weeks.

He has treated 22 cases of cold abscess by this injection, and in 20 a speedy and a perfect cure followed. In no instance were any of the phenomena of iodoform poisoning produced. The method appears to be well adapted for large abscesses.

THE TREATMENT OF VARICOSE VEINS.

SURGEON-MAJOR STEVENSON (*Lancet*, 1886, vol. ii. p. 709) gives his experience of the treatment of varicose veins by the injection of carbolic acid—a measure advocated by Mr. Watson Cheyne.

The treatment consists in the injection of one minim of pure carbolic acid at different situations into the enlarged veins, having previously cut off the circulation from the limb by means of an elastic bandage placed above the highest point of puncture. Injections of pure carbolic acid, one minim each, are then made into the veins at about one inch and a half apart—as many as may be required for each case. A little pledget of absorbent carbolized cotton-wool is placed over each puncture as the needle is withdrawn, and well soaked with collodion; this is allowed to remain until, in the course of time, it falls off, when healing will usually be found completed. The elastic bandage should not be removed in less than fifteen minutes after the last injection has been made, and great care should then be taken not to remove it suddenly. For at least a week after the operation the patient should not assume the erect position or put his foot to the ground for any purpose whatever. The pain is very slight and no anæsthetic is required. “I have done,” writes the

author, "as many as eighteen injections in one case; and it seems to me advisable to begin with the injection next to the elastic bandage—that is, the one highest on the limb. Getting the point of the needle well into the vein is not quite so easy a matter as might at first appear; attempts to do so at right angles to it frequently fail, and the injection is thus made into the surrounding tissue. The best plan is to fix the skin over the vessel by means of the left thumb, close below the point selected for puncture, and to direct the needle through the skin and coats of the vein in the long axis of the latter. I should think that, in my cases, somewhere about ten per cent. of the punctures caused suppuration, a little abscess about the size of a pea forming where this occurred; but this process, as the result of the caustic action of carbolic acid, was curiously slow and almost absolutely painless."

Dr. Stevenson has treated eight cases by this method with in each instance a certain and permanent good result. On theoretical grounds the procedure should involve some risk. It may be a question also, whether the results will always be so satisfactory as the small number of cases show.

Strong arguments must be adduced to persuade surgeons to abandon the certainly most successful operation of excision for these cases.

DISLOCATION OF THE HIP.

PROFESSOR HUMPHRY (*Lancet*, 1886, vol. ii. pp. 1011, 1247) has published a most important paper on this subject. He deals with the dorsal dislocation, and founds his remarks upon the detailed dissection of three specimens and upon certain experiments upon the cadaver. "I think," he writes, "it is certain that in each of these three cases the head of the femur passed out of the acetabulum, not at the notch where the capsular ligament is weakest and the resistance to its escape is least, but further back, opposite the *tuber ischii*, at the part where the rent in the capsule radiates in three directions, and where, accordingly, the first strain upon the capsule must have been greatest. In the first and second cases this was just below the level of the obturator internus and the gemelli. In the third case it must have been rather higher—*i. e.*, beneath the obturator internus, the tendons of which were torn away from the muscle by the force of the head of the bone thrust out beneath it. All three cases were, in short, examples of direct dislocation, and in none of them was the cotyloid ligament or the margin of the acetabulum injured. It has been maintained, upon sufficient grounds, I think, that the dislocations of the hip backward are always, or almost always, indirect, that the head of the bone escapes from the acetabulum close to the transverse ligament, and is then, if the limb be in an inverted position, carried backward and perhaps upward. Furthermore, it is held that the accident occurs during the abducted position of the limb. I quite grant that the capsule is weakest and least supported by muscles in this situation, and that dislocation is easily caused here, in the dead body, by forcible abduction of the limb. But it is to be remembered that the capsule is weakest here, because in the living body it is least liable to be strained in this direction."

Professor Humphry maintains: 1. That the position of the rent in the capsule, through which the head of the bone escapes from the acetabulum, is not at the lowest part, but at the lower and back part, behind the pubo-femoral

ligament. 2. That the dislocation occurs commonly when the limb is adducted, flexed, and inverted, and not when it is abducted. 3. That the dislocation is direct, and not indirect. Professor Humphry states that in most recorded cases the limb appears to have been in the position of adduction at the time of the accident, and that the method of reduction by manipulation supports his view as to the course followed by the bone in its escape.

MR. HENRY MORRIS (*Ibid.*, p. 1165) directly confutes Professor Humphry's conclusions, and maintains that the rent is in the lowest part of the capsule, that the dislocation is indirect, and that it really occurs when the limb is in the position of abduction. Mr. Morris believes that the recorded cases demonstrate that the accident most commonly happens when the limb is in the position named, and that the method of reduction by manipulation supports his conclusions.

Mr. Morris does not differ—except upon the question of the position of the rent in the capsule—from Professor Humphry upon the anatomical data of the lesion, but he cannot accept the interpretation placed upon these facts. The two papers furnish the most valuable contribution to this subject, and the weight of evidence so far appears to incline to the side taken by Mr. Morris.

GANGRENE OF LIMBS.

DR. SCOTT LANG (*Edinburgh Medical Journal*, January, 1887) has published a paper with this title, "To Ascertain whether Gangrene is likely to Follow Severe Injury of a Limb." The author recommends the following method: "Gently raise the limb, and keep it raised for two or three minutes, in order to empty it to some extent of blood. Then apply a tourniquet or piece of elastic webbing on the proximal side of the injury, and keep it applied for about a minute. Lower the limb, remove the tourniquet, and, if sufficient circulation remains, the part beyond the seat of injury will blush very red, and will show in an unmistakable manner the condition of the bloodvessels."

GASEOUS TUMORS OF THE NECK.

DR. PAUL FABRE (*Gaz. Méd. de Paris*, 1886, p. 373) reports the following cases: (1) A female child, aged two and a half months, had bronchitis. On the third day a swelling was noticed in the right supraclavicular region. There had been no injury. The tumor had all the characters of an emphysematous swelling. It was increased by coughing, and also during crying. As the cough subsided the tumor slowly disappeared. The author surmises that the swelling was due to rupture of the thyro-hyoid membrane, a diagnosis that does not commend itself.

(2) A male child, aged one month, with a congenital tumor in the front of the neck. The tumor contained air, and subsided quickly and entirely at each inspiration, swelling out again at each expiration. It was the size of a goose's-egg, and was covered with normal integument. The upper part of the sternum was absent. Indeed, no part of that bone could be made out above the level of the fifth costal cartilage. The first ribs appeared to have joined across the median line. It is evident that the wall of the trachea was deficient. The clavicles were normal. The author concludes with an account of other reputed cases of cervical tumor containing air.

M. GIRAUD (*Revue de Chirurgie*, No. 11, 1886), under the title of "Traché-ole," reports the following case: A woman, aged forty-one, was stabbed in the neck with a knife. The stab was deep and involved the air-passage. The wound healed well. After cicatrization the patient developed a cough, and under the scar a tumor containing air slowly made its appearance. It was on the left side, was the size of an orange, and had the shape and site of a goitre. It was barely to be seen during inspiration, but at once swelled out on coughing. It was evidently due to hernia of the tracheal mucous membrane, and communicated with the trachea. To the paper is appended an exhaustive account of the reported examples of aërial cervical tumors.

MR WHEELER (*Dublin Journal of Medical Science*, November, 1886) reports, under the title of "Pharyngocele," the following remarkable case: A man, aged fifty-seven, suffered from recurrent attacks of bronchitis, laryngitis, and tonsillitis. On lying down he was troubled by a sense of choking, as if a solid mass occupied the throat. His speech was indistinct. He suffered from intense fits of coughing and dysphagia. A tumor existed in the right sub-maxillary region, that varied in size and was tympanitic on percussion. It proved to be a diverticulum formed from the pharyngeal mucous membrane. The swelling was exposed, a piece of the wall of the hernia-like cul-de-sac was removed, and the wound thus made closed by sutures. The patient made a speedy and complete recovery. Mr. Wheeler believes this to be the first case of pharyngocele cured by operation.

TONSILLAR CALCULI.

PROF. TERILLON has published (*Archives Générales de Médecine*, August, 1886) an elaborate paper upon the subject.

The subjects of tonsillar calculus are liable to repeated attacks of sore throat, associated with much œdema of surrounding parts, and ending in abscess, with usually the discharge of some concretions.

The persistence of these attacks and their frequent repetition should suggest calculus, and the stone can often be detected at the bottom of the ulcer left by the bursting of one of the abscesses.

The calculi are hard and white and often deeply imbedded; their early removal is important, and effected without difficulty.

INTRAGLANDULAR EXTIRPATION OF GOITRE.

In the place of total extirpation of the thyroid body, DR. GARRÉ (*Centralblatt für Chirurgie*, No. 45, 1886) advises the shelling out of the degenerated portion of the gland. In many examples of goitre the disease occurs in the form of circumscribed masses, each of which is separated from the healthy thyroid by a more or less defined capsule.

The capsule is recognized by its regular outline and pale, bluish, transparent wall. Dr. Garré acknowledges that these masses may, especially when deep, be difficult to find, and their removal may involve a deep wound in the vascular thyroid. When once discovered, they are readily shelled out by the finger or some blunt instrument. The bleeding is said to be of no great moment. The cavity left after the extirpation of one or more of the masses is drained.

The operation has been performed in fifty cases by Professor Socin with good results, and without the danger and deformity that attend the removal of the entire gland.

THE PATHOLOGY OF THE THYROID GLAND.

MR. VICTOR HORSLEY (*Lancet*, December, 1886) gives an account of this body that bears in an important manner upon the surgery of the part. He shows that the gland is an excretory, or, rather, a metabolic organ, without being provided with the usual duct of such organs. It also possesses some sort of hæmapoietic function, since the number of red blood-disks in the efferent vein is greater than their number in the afferent artery. Whether the gland exercises any power of forming the fluid portions of the blood must remain at present a doubtful matter. It appears to be a maker of corpuscles only. Mr. Horsley believes that the relation of the thyroid gland to the brain is an apparent and not a real one, and experimental evidence is adduced to prove this position. An adult fox terrier, from whom one lobe of the thyroid gland was removed, was submitted to experimental excitation of the cerebral hemispheres after the expiration of a period of 271 days. An adult black-and-tan dog was similarly the subject of an experiment 109 days after removal of one lobe of the thyroid. Also a bonnet monkey, 84 days after a similar operation. The motor centres of each of these animals were exposed under precisely similar conditions. Excitations with the faradic current were made to each motor part of the hemisphere in each animal, and with the result that no difference could be detected on the two sides. The period of latency, tonic spasm, and clonic spasm—epileptic motor phenomena—were precisely the same whether the right or left hemisphere was stimulated. It was clear then that removal of the one lobe of the thyroid had exerted no detectable influence over the nutrition of the motor cerebral centres on the same side.

Mr. Horsley states that there is no experimental or clinical evidence that the thyroid gland is represented in the cerebral hemispheres. The gland receives from the medulla oblongata sympathetic fibres, which pass down the cervical part of the spinal cord as far as the eighth cervical nerve, and then leave the cord and proceed upward in a direction almost parallel to their former direction in the cord, and are distributed to the glands along the arterial vessels. The gland appears also to receive nerve fibres from the recurrent laryngeal nerve, which are probably derived from the motor nucleus of the spinal accessory.

In order to place on an experimental basis the subject of innervation of the gland, Mr. Horsley performed two experiments on dogs. In each dog an inch of the recurrent laryngeal nerve was excised on one side. One dog was kept alive nine and the other eleven months. But there was no histological difference to be detected between the lobes of the thyroid in either case.

The following experiments, to illustrate the comparative pathology of the thyroid, are interesting.

The suggestion is made that where the glands and acini are small, functional activity is slight. One experiment was made on a donkey. The thyroid gland was excised in August, 1885, and the animal died in 205 days. The chief symptoms for two months were emaciation and weakness; the mental hebetude, if any, was difficult to gauge; the temperature of its body was but

slightly lowered. In March, 1886, when the weather became severely cold, nervous symptoms suddenly supervened, and tremors were observed for three days, chiefly in the muscles of the head and neck. On the fourth day these were complicated by constant twitching; the animal became so weak as to be unable to stand, and the body temperature became markedly lowered. Later still, muscular rigidity was observed, and also the paralysis increased, especially in the jaw. On the fifth day of the cold weather the donkey became much worse, and died in the morning. This experiment seemed to show that the gland in the donkey was of but relatively little importance, and the case also brought out very clearly the malignant influence of cold when the thyroid gland was inactive or had been altogether removed. Two experiments had been made in sheep, which have a comparatively good-sized thyroid gland, but though the operation was performed in October, 1885, the animals were still well. In two pigs, the removal of the thyroid was followed by characteristic symptoms of tremors, leucocytosis, and anæmia, with subnormal temperature.

RUPTURE OF THE BLADDER.

SIR WILLIAM MACCORMAC (*Lancet*, December 11, 1886) contributes an account of two cases. In both the rupture was intraperitoneal. The author draws attention to the rarity of the accident, and to the great mortality that attends it, and gives an excellent account of the literature of the subject.

The first patient was a man, aged thirty-five, who was struck violently on the abdomen. He walked home—a distance of 250 yards. The symptoms were vomiting, pain, strangury, with inability to pass water. The man was sober, and had emptied his bladder an hour and a half before the accident. He was admitted fifteen hours and a half after the injury. A catheter was passed, and one and a half ounces of blood and urine drawn off. Laparotomy was performed. The rent in the bladder was on the posterior aspect, was median and vertical, four inches in length, and extended from the superior fundus to the recto-vesical cul-de-sac.

Sixteen silk sutures—involving the serous and muscular coats—were introduced according to Lembert's method; and six catgut sutures that involved the peritoneum only. The peritoneal cavity was washed out with a solution of boric acid. A glass drainage tube was introduced, and a catheter tied in the bladder. The operation was performed under antiseptic precautions, and occupied two hours. The patient made an excellent recovery.

The second case was that of a man, aged thirty-seven, who fell a distance of eighteen or twenty feet, in a sitting posture, upon soft clay. The man was sober, and the bladder had been emptied one and a half hours before the accident. Laparotomy was performed twenty-seven hours after the injury. The rent was two inches in length, and was placed obliquely on the upper and posterior part of the bladder. Fifty ounces of serum and urine escaped from the peritoneal cavity. The case was treated in the same manner as the above, twelve sutures being employed. The patient made a rapid recovery.

Both patients were fat, heavy men. In neither was there any collapse. Sir William MacCormac gives an account of the various operative procedures that have been devised and practised for the relief of this injury.

DRS. BROWN and MCGILL (*Ibid.*, Nov. 20, 1886, p. 971) record two examples of rupture of the bladder. The first patient was a man, aged twenty-six, whose bladder gave way while straining at stool. A catheter was passed, and four ounces of urine drawn off with some blood-clot. A trocar was introduced midway between the umbilicus and pubes, through which much urine drained.

The day after the accident the bladder was opened by a median perineal incision, and a drainage tube introduced. The man died shortly after the operation. The post-mortem revealed peritonitis, and a small rupture—capable of admitting the forefinger—was found at the posterior surface of the bladder, outside the peritoneum.

The second patient was a man, aged fifty-four, who was knocked down when running. He had been drinking. A catheter drew off a quarter of a pint of bloody urine. On the fourth day after the accident laparotomy was performed. A large rent was discovered in the posterior wall of the bladder involving the peritoneum. The viscus was brought into better view by distending the rectum with an air tampon. The bladder wound was closed by sutures. The patient died next day.

DR. ARMSTRONG (*Ibid.*, Nov. 13, 1886) records a case of recovery. The patient was a girl of sixteen, who fell from a window into the street. She was much collapsed, was severely bruised, and was found to have sustained a fracture of the astragalus and of other bones. Bloody urine was drawn off by catheter. An irregular rent, four inches long, was found in the anterior wall of the vagina involving the bladder. This wound was at once carefully closed by sutures. The patient made a sound recovery. Dr. Armstrong regards the case as an example of rupture of the empty bladder by indirect violence.

LITHOLAPAXY IN MALE CHILDREN.

SURGEON-MAJOR KEEGAN (*Lancet*, 1886, vol. ii. pp. 1068 *et seq.*) gives an account of 58 litholapaxies performed on boys at the Nidore Hospital, Central India. The ages of the patients varied from one and three-quarters years to fourteen years. The size of the lithotrite used was between No. 7 and No. 11. The stones were of all kinds. The heaviest weighed 700 grains. It was a uric acid stone with a nucleus of oxalate of lime and a covering of phosphates. The patient was nine and a half years of age; symptoms had existed for two years. The operation was performed at one sitting and occupied 182 minutes. The lithotrite was introduced twenty-six times. The patient was in the hospital ten days and made a good recovery. Other stones weighed 360, 344, and 285 grains. In only one instance did death follow. The operation was successful in 57 of the cases. Dr. Keegan greatly prefers litholapaxy to lateral lithotomy for male children. Lithotrity he justly condemns. He examines the objections to litholapaxy in children, the chief being the smallness of the bladder, the narrowness of the urethra, and the great sensitiveness of the genital-urinary mucous membranes. He states, in answer to these objections, that he has never found the size of the bladder an obstacle to the operation, and he does not think that he has ever damaged the mucous membrane of the urethra or bladder.

With regard to the calibre of the urethra, Dr. Keegan states that he has never found any difficulty in introducing the instrument. The meatus may

often have to be incised, but the canal itself is much larger in boys than is supposed. As a rule, the urethra of a boy from three to six years of age will admit of No. 7 and No. 8 lithotrite (English scale); while the urethra of a boy of eight or ten years of age will admit a No. 11, a No. 12, and even sometimes a No. 14 lithotrite.

In one child, aged two, a No. 7 lithotrite was used and a No. 9 catheter. In another child aged one year and nine months, a No. 7 lithotrite was employed.

The paper enters into details of the chief cases, and forms a most valuable and practical addition to this branch of operative surgery.

A NEW METHOD OF EXPOSING THE KIDNEY.

PROFESSOR KÖNIG (*Centralblatt für Chirurgie*, 1886, No. 35) advises the following operative procedure. The incision is carried at first downward from the last rib to a point a little above the iliac crest and near the outer margin of the erector spinæ. It is then directed upward in a curved manner as far as the outer border of the rectus muscle, about the level of the umbilicus.

The muscles exposed by this double incision—which is increased in extent when necessary—are next divided and the kidney exposed behind the peritoneum, which is stripped from it. If it be desirable for any reason to approach the kidney from the abdominal cavity, the peritoneum is divided along the course of the oblique anterior incision. If the kidney so exposed contain pus, it is advised that the wound in the peritoneum should be closed when the organ has been freed and before it is cut into.

The author gives two examples of this latter procedure, both of which were successful. One concerned a case of renal calculus, the other a suppurative pyelonephritis. After the kidney has been dealt with, various layers of divided muscle must be united by sutures in their proper order. In order to facilitate this step, Professor König advises that a suture be passed through each divided muscle as it is incised. The sutures are retained for three weeks and the patient kept in bed for at least four weeks after the operation.

HEPATIC SURGERY.

DR. GEORGE HARLEY (*Brit. Med. Journ.*, 1886, vol. ii. p. 899) gives an account of an operation he terms "hepatic phlebotomy." He points out that neither cutting nor leeching the abdominal parietes can have any direct effect on the amount of blood present in an inflamed liver, since no direct communication exists between the bloodvessels of the abdominal walls and those of the hepatic organ.

He advises the direct tapping of the liver to relieve certain cases of engorgement and inflammation: and draws attention to the harmlessness of this operation in healthy animals. He gives the case of a woman of intemperate habits, aged thirty-eight, who was suffering from severe hepatitis with dropsy. The patient was anaesthetized and the upper part of the liver was pierced from right to left with an eight-inch trocar of a diameter between a No. 2 and No. 3 English catheter. Twenty ounces of blood were allowed to escape, the trocar having been driven in up to the hilt. An excellent result followed. He also advises puncturing of the liver capsule as a remedial measure in cases of chronic congestive hypertrophy, and gives examples of this mode of treatment.

MR. KNOWSLEY THORNTON (*Ibid.*, p. 901) gives details of a series of cases of operation upon the liver including the evacuation of hepatic abscess, of suppurating hydatid cysts, and the removal of gall-stones. In one case of non-suppurating hydatid cyst, the cavity was sponged out with tincture of iodine and allowed to close.

MR. WILLETT (*Ibid.*, p. 903) reports a case of cholecystotomy in a woman, aged fifty-two. The incision was three inches long and was made in the right semilunar line. The bile-duct was found occluded by a chronic inflammatory stenosis. The gall-bladder was distended, but contained no gall-stone, neither was any growth found in its vicinity. Its walls—after opening—were stitched to the abdominal parietes. The patient recovered with a biliary fistula.

MR. HOWARD MARSH (*Ibid.*, p. 905) deals with a case of hepatic abscess in a boy aged eleven and one-half years. The abscess was opened and drained and the edges of the wound stitched to the abdominal wall. Thirty-six ounces of pus escaped. The patient recovered with a biliary fistula.

MR. LAWSON TAIT (*Ibid.*, p. 905) reports a remarkable series of 50 cases of operation on the liver. In 7 exploratory incisions were made, the cases being chiefly instances of tumor of the liver. In 13 instances laparotomy was performed, for the most part for the relief of hydatid cyst. In the remaining 30 cases the operation of cholecystotomy was carried out. Out of this number of 50 cases, only 2 died of the operation. Details are given of some of the more important examples.

M. POULET (*Bull. et Mém. de la Soc. de Chir.*, Paris, t. xii. p. 129) reports one case of hydatid cyst of the liver treated by operation. He advises incision in the place of puncture, the removal of as much of the sac as possible, and stitching of its margins to the edges of the divided peritoneum.

OPERATION FOR FECAL ACCUMULATION.

DR. P. MORRIS (*Brit. Med. Journ.*, December 18, 1886) reports this case.

The patient, a woman, aged twenty-four, was the subject of intestinal obstruction due to the above cause. The symptoms were chronic. Hard masses were felt in the abdomen. The rectum was blocked with feces, the removal of which led to no improvement. Enemata were unavailing. Vomiting became distressing, and the patient much emaciated.

The patient being anæsthetized, the whole of the tissues of the anus back to the coccyx were divided, in order that the hand might be freely introduced into the bowel. By the side of the hand a long tube was passed, through which warm soaped water was injected. Dr. Morris thus continues: "At the top of the pelvis I came across the big mass which I had so often felt and vainly attempted to remove; but now I could easily crush it. The arm was now withdrawn, when the whole was expelled. After reintroducing the arm I found that the colon was in a very abnormal condition, because, instead of there being an ascending, transverse, and descending colon, it was one tremendously distended chamber, and with my whole arm introduced up to the axilla, I could, on account of her great emaciation, investigate and manipulate every part of the abdominal cavity, with the other hand externally. Strange to say, in the neighborhood of the right iliac fossa I found an oval opening large enough to allow the passage of a good-sized plum (an inch and a half

long), with a well-defined margin. This was plugged with a lump of hard fecal matter, which was removed and crushed." Dr. Morris supposes this opening to have been the ileocæcal valve. The colon having been well cleared out, the perineal wound was sutured. An excellent recovery followed.

There is no clear evidence to show that the colon was arranged as Dr. Morris assumes. If the colon be distended, it will become enlarged in both its transverse and longitudinal axes, and will probably measure not less than six feet. This distance can hardly have been traversed. Dr. Morris appears to have explored and evacuated a very large sigmoid flexure, the summit of which when distended may reach to the diaphragm. The deformity of the colon alluded to is not familiar to anatomists, and the opening supposed to be the valve was of unusual dimensions. The operation was admirably planned and carried out.

INTUSSUSCEPTION WITH MALIGNANT DISEASE.

DR. KULENKAMPFF (*Centralblatt für Chirurgie*, No. 47, 1886) reports the following case: A woman, aged thirty-nine, had suffered from partial obstruction of the bowels with a bloody discharge from the anus for six months. In due course a mass, considered to be a polyp, could be felt in the rectum. This proved to be a papillomatous (and probably malignant) growth that took origin in the sigmoid flexure, and had led to an invagination of that part of the colon into the rectum. The entire mass, together with the intussusception, was removed through the rectum. An adherent coil of bowel was accidentally wounded, and the wound was closed by sutures. Symptoms of obstruction set in, and on the tenth day after the operation laparotomy had to be performed and an artificial anus made on the left side. The patient recovered, but with a fecal fistula.

The following recent papers may be noted:

"Hemorrhage from the Innominate after Tracheotomy," by Dr. Hutton (*Brit. Med. Journ.*, December 4, 1886, p. 1102). A boy, aged one and a half years. Operation for laryngitis of three weeks standing. Death from bleeding on the twelfth day. An ulcer was found on the anterior wall of the trachea, at the level of the lower end of the tracheotomy tube, that had opened the innominate artery.

"Acute Peritonitis Treated by Laparotomy," by John Taylor (*Brit. Med. Journ.*, December 18, 1886, p. 1212). Female, aged twenty-one. Recurrent febrile attacks with left iliac pain following labor. Seven weeks after labor, acute general peritonitis. Laparotomy. A burst pelvic abscess found. Abscess sac removed, peritoneum washed out. Recovery.

"Bacteriology in its Relations to Surgery," by Henry Power (*Lancet*, 1886, vol. ii. p. 1111). This paper, delivered as the Bradshawe Lecture, gives a masterly exposition of the present state of our knowledge on this subject. See also "Microörganisms in Relation to Surgery," by Dr. Heuston (*Dublin Journal of Med. Science*, January, 1887).

"Resection of the Knee," by M. Lucas-Championnière (*Revue de Chirurgie*, January, 1887). A report of eleven examples of the operation performed in adults. Ten for tubercular arthritis, and one for arthritis deformans. In all

an excellent result followed. The paper is illustrated by figures of the special splints and drainage tubes used.

"Hydatids in Bone," by Professor Müller (*Beitr. zur Klin. Chir. Tübingen*, 1886). Case of hydatid cyst in the humerus. An analysis of forty-three recorded cases, with a full account of the clinical history, prognosis, and treatment of this rare condition. A valuable monograph.

"Extroversion of the Bladder," by M. Richelot (*L'Union Médicale*, October, 1886). A useful description of the procedure known as "Le Fort's modification of Wood's operation."

"What Constitutes Malignancy?" by Herbert Snow (*Lancet*, 1886, vol. ii. pp. 719, 770). The author enters largely into the microscopical anatomy of malignant tumors, and concludes with these words: "Briefly to sum up what I have said, the phenomena of malignancy result from conditions which irritate normal protoplasm, cause it to proliferate abnormally, and to assume quasi-independent parasitic vitality. These conditions may be mechanical; in a much larger proportion of cases they are neurotic."

"Acute Glossitis," by Dr. Totherick (*Lancet*, 1886, vol. ii. p. 724). A report of two cases. The patients were males, ages twenty-one and twenty-seven. The attack appears to have been of spontaneous origin in each instance. The cases occurred in the month of July. Dr. Totherick gives an account of the literature of the subject and of the symptoms of this rare disease.

"Rupture of Synovial Membrane of Knee," by M. Pruvost (*France Méd.*, 1886, No. 85). Man, aged forty-five, with gonorrhœal rheumatism. Great distention of knee-joint. During abrupt movement in bed sudden disappearance of swelling and pain. Supposed spontaneous rupture of synovial membrane.

"Traumatic Tetanus Cured by Removal of Cicatrix and the surrounding Parts," by Mr. Cotterill (*Lancet*, January 1, 1887). Man, aged thirty-nine, wound of thumb with broken glass. Tetanus on twelfth day; chloral, potass. bromide, eserine, etc., had no effect. Scar and parts around excised on the twenty-second day of the tetanus: immediate improvement and recovery.

"Surgical Mishaps," by Pridgin Teale (*Lancet*, January 1, 1887). 1. Disappearance of tumor after ineffectual attempts at removal. 2. Chronic inversion of uterus: attempted taxis: laceration of vagina into Douglas's pouch. 3. Wound of popliteal artery and vein during an operation for necrosis. Recovery without gangrene.

"Lipomata of the Hands and Digits," by M. Poulet (*Revue de Chir.*, 1886, No. 8). An account of all the recorded cases of this rare affection, and of the difficulties in the way of diagnosis.

"Congenital Dislocation of the Patella," by Dr. Bessel-Hagen (*Deutsche med. Wochens.*, 1886, No. 3). Three examples of this very uncommon condition, with an account of thirteen other recorded cases. The bone was displaced outward. In some cases the luxation was incomplete; in others, complete and permanent; in a third series complete in the flexed position only.

"Actinomycosis in Man," by Dr. Moosbrugger (*Centralblatt für Chirurgie*, December 25, 1886). An account of ten recent cases and an analysis of the details of no less than seventy-five recorded examples of this disease.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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EXTRACTION OF SOFT CATARACT BY INJECTION.

In 1884 DR. A. McKEOWN introduced to the members of the British Medical Association a method of extraction of soft cataract by intracapsular injection of water. In the *British Medical Journal* for January 15, 1887, CHARLES G. LEE cites six cases operated upon by himself with highly satisfactory results. The method employed is briefly as follows: The operation is preceded by the usual cataract incision at the corneo-scleral margin, and an iridectomy; then a reservoir of water (pure water, not an aseptic solution) is held by an assistant at varying heights above the patient's head, according to force of the stream desired. A simple rubber tubing connects the reservoir with the terminal which conveys the fluid to the parts desired. The terminal is introduced well in the capsule, often right across the area of the pupil to the lower edge of the iris, or wherever cortical matter was seen. It was most interesting to watch the pieces of cortex slowly floating up, sometimes from behind the iris toward the incision, then to escape with the outgoing stream.

Dr. Wicherkiewicz, of Posen, has adopted the principle, and Mr. Edgar Browne spoke favorably of the method as a valuable aid in removing sticky cortex.

CILIARY CORRECTION OF CORNEAL ASYMMETRY.

In *Annales d'Oculistique* for September and October, 1886, DR. GEORGES MARTIN brings a wealth of clinical support to the thesis of the preceding month. (See *The American Journal of the Medical Sciences* for January, 1887, p. 267.) The most noteworthy practical conclusion is the author's recommendation that when corneal astigmatism is small the total correction may be given at once, but if it is of a medium or large degree it is best to begin with spectacles correcting only the manifest astigmatism, and as the ciliary muscle becomes habituated to the new conditions the more complete correction may be successively added until the total astigmatism is neutralized by the lenses. This presupposes an understanding on the part of the patient of the changes to be made, and the assurance that the glasses will be worn without interruption.

In a subsequent chapter the author tabulates and discusses 70 cases in which the ciliary correction of the corneal astigmatism does not stop with the neutralization, but passes over into a condition of over-correction. This, of course, rarely happens; 45 cases occurring out of 3000 examined. The extent of the over-correction runs from 0.25 to 0.75 D.; though exceptional instances run higher. The corneal astigmatism was generally 0.25-0.5 D. The ophthalmometer is alone capable of differentiating the diagnosis. If the over-correction is a recent production, the author advises the persistent use

of atropine for a month; if this fails to break up the over-correction, it may be deemed as permanent, and cylindrical glasses given according to the subjective examination. For chronic cases this is done at once.

ENUCLEATION AND EXENTERATION.

PROFESSOR SCHWEIGGER's lecture before the Berliner medicinischer Gesellschaft, on the above subject is published in the *Berliner klinische Wochenschrift*, of December 13, 1886. The operation of exenteration is held to be preferable to enucleation in cases where ruptures and wounds of the cornea and sclerotic are of such a nature that suppurative choroiditis and atrophy of the globe are inevitable. In other cases of suppurative choroiditis with inflamed and swollen orbital tissues exenteration is also advised. In sympathetic ophthalmitis resection of the optic nerve is considered better than either enucleation or exenteration. Since 1863 there have been twenty-four fatal results of enucleation, though none have happened in the lecturer's practice, who confesses that he has resorted to the *hässlichen operation* as little as possible. A most urgent and praiseworthy warning is given against the too common haste of enucleation in cases of intraocular tumors. "The more uncertain the diagnosis, the quicker is enucleation proceeded with."

The method of operation in exenteration is to divide the conjunctiva at the corneal margin, excise the cornea, and disembowel the globe with a sharp spoon, leaving only the scleral shell. The conjunctival edges are then sewed together. The time required for healing is greater than in enucleation. A serviceable stump must not be expected, as in a few months the sclerotic will atrophy and shrink to a small and useless relic.

PARASITICAL DISEASES OF THE EYE.

PROFESSOR ZEHENDER's Bowman Lecture before the meeting of the Ophthalmological Society of Great Britain (*The Lancet*, Dec. 4, 1886) reviews those ocular affections that are caused by parasites and microorganisms. Concerning *Filaria loa*, or Guinea worm, the learned lecturer speaks of it as only existing in the eyes of negroes; but the reviewer has been told by missionaries that it infests the eyes of Europeans living in western Africa as well, and we now have a worm three inches long taken from an American gentleman who had lived many years in Guinea. Dr. Reading, of Woodbury, N. J., removed the parasite from the right eye of the patient.

Concerning cysticerci, it is incidentally explained why so many more cases are found in North Germany than in more southern countries. It is because the cysticercus with hooks, the first stage of the tapeworm infesting the human digestive tube, has its habitat in the hog, and pork is more largely an article of diet in North than in South Germany. The successful extraction of thirty in forty-five cases by Alfred Gräfe, of Halle, from 1877 to 1885, is emphasized as proof of the advisability of the procedure; the opening, preceded by a large iridectomy is made through a scleral wound just outside of the corneo-scleral margin.

Of *echinococcus hominis*, rarely found outside of Iceland, there are at present reports of about forty cases. The antiseptic method of Lister is approved, and phlyctenular conjunctivitis, purulent ophthalmia, trachoma,

saccus lacrymalis, ulcus serpens, keratitis-hypopyon, and keratitis-mycotica are attributed to microörganisms.

Concerning trachoma, besides the standard remedies, the author speaks approvingly of the method of "squeezing, cutting, or scratching out the follicles," as having proved itself useful, and "bacteriologically quite correct."

ETIOLOGY OF CONSTITUTIONAL DISEASES OF THE EYE.

In the lecture of TWEEDY (*Lancet*, January 8, 1887) a valuable distinction is made as to the location of constitutional diseases of the eye. The structures of the eye as developed from the *epiblast*, are the retina and the optic nerve, lens, epidermis, corneal epithelium; those from the *mesoblast* are the fibro-vascular tissues, cornea, sclerotic, iris, choroid, vitreous, capsule of lens, and muscles. Now it is held that the ocular affections due to the strumous diathesis, localize themselves particularly in the epiblastic structures, *e. g.*, the phlyctenular of the epithelium or anterior layers of the cornea, or of the circumcorneal zone of the conjunctiva. The same general class of structures is shown by inflammations dependent upon neuropathic causes, as diseases of the fifth nerve, or herpes; the corneal implication is superficial. But in hereditary syphilis the mesoblastic structures are selected, and in particular the deeper layers of the cornea, the iris, etc. Since, now, drugs seem to have also a selective affinity for special tissue elements, the suggestion follows that with the advance of therapeutic science, this distinction above bespoken will serve as a key to a rational progress in the treatment of ocular diseases.

NEURO-RETINITIS AND CHRONIC BRIGHT'S DISEASE.

In the *Transactions of the Am. Oph. Soc.*, 1886, DR. CHARLES STEDMAN BULL gives a careful and thorough analysis of 103 cases of Bright's disease, with the retinal manifestations, extending over a space of thirteen and a half years, and constituting about 20 per cent. of the total of such cases under his care during this period. The 80 per cent. not bespoken are the cases whose history subsequent to the first examinations was not recorded; all cases due to scarlet fever or pregnancy were excluded.

The vision was improved by treatment in 32 cases (31.5 per cent.), but the visual improvement (or relapse) was, as a rule, dependent on the changes of the renal disease. There were 46 retinal hemorrhages of both eyes, and in 23 patients the hemorrhages occurred in single eyes. In some cases there was papillitis, without the characteristic retinal exudation, though the exudation appeared later, not necessarily stellate, however. Diminution of the calibre of the retinal arteries was not constant. Absorption of the stellate exudation was never observed, however great the improvement of vision [the Reporter, however, has observed such absorption in some cases]. The author thinks no case of chronic interstitial nephritis is ever cured after cardiac hypertrophy and neuro-retinitis has set in. Attention is called to the unfavorable prognosis in these cases: Of the 103 patients, 86 (over 50 per cent.) died within one year after the first examination, and 18 within the second year; of the 103, only 17 survived at the time of reporting. Dr. Gruening, in the following discussion, stated that out of over 100 cases of his own, none lived over two years after the diagnosis of retinitis albuminurica had been made.

ORIGIN OF CHOROIDITIS DISSEMINATA.

In his address before the Section of Ophthalmology, at the annual meeting of the British Medical Association, in Brighton (*British Medical Journal*, Jan. 15, 1887), MR. JONATHAN HUTCHINSON finds reason to believe in the non-syphilitic origin of certain cases of disseminated choroiditis. The conclusions reached are these:

1. That concussion of the eyeball may produce choroiditis, but limited to the eye injured.
2. That binocular choroiditis disseminata may arise independently of syphilis in association with disorders of the nervous system, especially of the intellect.
3. That young men are liable to a peculiar form of hemorrhagic choroiditis, not dependent on syphilis, producing results indistinguishable from the syphilitic forms.
4. That there are yet other unclassifiable forms of disseminated choroiditis whose results resemble those of syphilis, but where no such disease can be reasonably suspected.

It was, of course, admitted by the lecturer that in nine cases out of ten the choroiditis was due to syphilis, acquired or inherited. The discussion following the lecture was, in general, in accord with the above conclusions. Every speaker seemed to take it for granted that the existence of interstitial keratitis is absolutely conclusive as to the presence of syphilis, an opinion we think also open to doubt. That disseminated choroiditis may arise without syphilis seems to us beyond question.

THE AMBLYOPIA OF SQUINT.

DR. O. F. WADSWORTH (*Boston Med. and Surg. Journal*, January 29, 1887) reviews the literature of the theory of *amblyopia ex anopsia*, and from his own cases he concludes against the proposition that the amblyopia of strabismus is caused by the ocular deviation. Three arguments have been relied on by the upholders of this theory:

1. That with no abnormality of the fundus or field, there is defective vision of the macula;
2. That a visual defect of like character is rarely found without squint; and,
3. That the amblyopic squinting eye improves in vision after tenotomy, disproving the congenital origin of the amblyopia.

Concerning the first point, Dr. Wadsworth finds that the vision of 57 cases of convergent strabismus, taken from his note-books, show an acuity of at least from $\frac{14}{XX}$ to $\frac{14}{XXX}$ in the squinting eye, a result considered not below what commonly happens in non-squinting eyes. As to the second point, 15 cases of amblyopia are adduced existing in non-squinting eyes, and without abnormality of appearance. Referring to the third argument, a faulty previous examination is believed to explain the supposed improvement after tenotomy: "When vision has been exhaustively tested before tenotomy, no real improvement is found after it." There is one important fact that might have been adduced by Dr. Wadsworth in disproof of the commonly accepted theory that amblyopia follows disuse, and that is the very common one that

no amblyopia results from even long-continued disuse in cataract. The reviewer removed the lenses in a case of congenital cataract of sixty years' standing, with an immediate resultant perfection of vision as to acuity, colors, and refraction, where before was only perception of difference between day and night. It is true that there is this possibility of difference between cataract and strabismus, if the matter be looked at from the standpoint of the accepted theory of *amblyopia ex anopsia*, and that is, that in cataract the mind seeks to preserve the possibility of vision, whilst in the other case it seeks to neglect and quench the function. The latter idea would appear to some too volatile, while to others it would seem a support capable of bearing much weight.

A CONTRIBUTION TO THE DOCTRINE OF RETINAL GLIOMA.

FREITEL gives a very minute description (*Archiv f. Ophthalm.*, xxxii. 1), clinical and microscopic, of a case of retinal glioma, from which it appears at least to be improbable that the glioma cells spread in this particular case from the primary tumor by way of the perivascular lymph-sheaths to the small disseminated metastatic patches in the nerve-fibre layer. Freitel thinks that the spontaneous power of locomotion of the tumor cells plays a very unimportant part in the heteroplastic dissemination of neoplasms in the interior of the eye. On the other hand, he thinks that the mode of origin of the metastases in the vitreous which are so often met with, may be more readily explained by assuming that the glioma was developed in intrauterine life, when the vitreous was still vascular, and that the foetal vessels of the vitreous form the paths by which the glioma cells entered the vitreous. In the case presented by Freitel, the growth was probably at birth smaller in the right eye than in the left eye, and grew very slowly.

OTOLOGY.

UNDER THE CHARGE OF

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DEFECTIVE HEARING IN RAILROAD OPERATIVES, IN RELATION TO THE SAFETY OF THE TRAVELLING PUBLIC.

DR. LICHTENBERG, of Budapesth (*Congress of Naturalists*, Berlin, 1886), has endeavored to show the importance of good hearing in railroad operatives, and also to demonstrate that locomotive engineers and firemen are liable to various ear-diseases in consequence of their exposing employment. He speaks of the paucity, and unimportance of optical, in comparison to acoustic signals (in Germany?). The writer examined 250 railway operatives and found 92—*i. e.*, 36.8 per cent.—affected with aural diseases. 32 cases were catarrhal in form, 3 were of labyrinthine disease, and in 36 instances the

disease had located in the external auditory canal. He then alluded to the statistics of railway accidents and claimed that, in view of the importance of the acoustic signals and the frequency of their occurrence, and also in view of the frequency of aural diseases in the operatives, railway accidents occur very probably as a consequence of defective hearing in the railway employés.

EPILEPTIFORM SYMPTOMS FROM DISEASE OF THE EAR.

DR. TRAUTMANN, of Berlin (*Congress of Naturalists*, Berlin, 1886), has related a case of exudative inflammation in the middle ear, in a girl, three years old, in whom there also ensued, as a consequence, epileptiform manifestations followed by peculiar paroxysms of another kind. The latter consisted in the falling of her head on her breast, unconsciousness for about one minute, then a deep inspiration and again consciousness. Several months later, Dr. Trautmann discovered unsteadiness of gait and uncertainty of speech, but no other motor or sensory disturbances. Both membranæ were retracted and in the left tympanic cavity there was a copious exudation. Paracentesis was performed and was followed by irrigation through the catheter. Shortly after the operation one of the above named attacks occurred, but after that they ceased to appear. It is held that the exudation was the cause of the epileptiform symptoms in this case. The writer expresses the opinion that in such cases of exudation in the middle ear, which occur with violent symptoms, and in which death may ensue in consequence of meningitis, infectious elements underlie the disease. He further claims that such cases occur often simultaneously in several members of a family, and at a time when nasopharyngeal catarrh is prevalent. The treatment in such cases consists in a prompt paracentesis of the membrana tympani and evacuation of the exudation from the drum-cavity.

THE ACTION OF PILOCARPINE UPON THE MUCOUS MEMBRANE OF THE TYMPANIC CAVITY.

W. KOSEGARTEN, of Kiel (*Archiv f. Ohrenh.*, Bd. 24, 1886), has found, contrary to the experience of Politzer, that treatment by pilocarpine is useful in cases of chronic dry catarrh of the middle ear, complicated by affections of the labyrinth. Good results cannot be accomplished by a few injections, but rather, if success in these chronic processes is to be obtained, a continued repetition of the injections must be maintained for at least six weeks. The best results have been obtained when the treatment has been carried out for three months. The rule has been to make a daily injection of, on the average, one centigramme of pilocarpine. In those cases in which the treatment extended over three months, the injections were omitted every seventh day. In cases presenting a transparent membrana tympani, and also in one instance of large perforation of the membrana, in which there had been a chronic purulent process, there was visible an intense congestion of the mucous membrane of the drum-cavity and of the membrana after each injection of pilocarpine, and sometimes a secretion was observed to take place in the middle ear. Upon these occurrences the author based his suppositions, that there occurs gradually in this treatment a loosening of the stiff tissues, together with a moistening and softening of the adhesions, and thus the rigid con-

ducting apparatus of the ear is made more readily vibratile again. It is claimed that even in cases of retained exudation absorption may occur, as was very evident in one case in which a previously very white and opaque membrana become normal in color and transparency during the treatment.

THE POSSIBILITY OF RECOGNIZING BY THE FORM OF THE SKULL CERTAIN TOPOGRAPHICAL FEATURES OF IMPORTANCE IN THE TEMPORAL BONE.

DR. OTTO KOERNER, of Frankfort-on-the-Main (*Archiv f. Ohrenh.*, 1886, Bd. 24, S. 67 and 68), maintains, by reason of his examinations of sixty skulls, that it is possible to locate, from observation of the external configuration of the skull, certain important points in its internal structure, especially the position of the middle fossa of the skull and sigmoid sulcus. The "index of the skull" is expressed by a quotient obtained by dividing the distance between the bridge of the nose and the most prominent point of the occiput by the distance between the parietal protuberances. This index varies from 1.55 centimetres in dolichocephalic crania to 1.07 centimetres in the brachycephalic. From tables presented, it appears that the floor of the middle fossa of the skull in the dolichocephalic lies higher above the external porus acusticus and the spina supra meatum than in the brachycephalic skulls.

Respecting the transverse sinus, it is shown that it, on the average, extends further outward and forward into the mastoid process in the brachycephalic than in the dolichocephalic skull. Independently of the form of the skull, this sinus lies further outward, on the average, on the right than on the left side. The sinus wall was of equal thickness on each side in ten per cent. of the cases, and thinner on the right side in seventy-seven per cent., and thinner on the left side in thirteen per cent.

The practical application of these facts, so far as concerns the operation for opening the mastoid, requires that the smaller the "cranial index" is, the further forward the opening should be made in the mastoid. In adult skulls, with a cranial index of 1.3 centimetres and under, it will be necessary, when possible, to operate in front of the line of attachment of the auricle, especially when the right antrum must be reached. In infants and little children, as is well known, a dangerous position of the transverse sinus does not occur.

THE QUESTION OF TREPHINING THE MASTOID PROCESS.

After an elaborate paper on the "Diagnosis and Treatment of Acute and Chronic Purulent Inflammation of the Middle Ear-tract, and their Complications," based on 2366 cases selected from over 20,000 cases seen in private and hospital practice, DR. SAMUEL SEXTON, of New York, considers as follows the question of trephining the mastoid (*Transactions of the American Otological Society*, July 20, 1886).

For purposes of drainage of the middle-ear tract, he favors keeping open the outlet through the tympanum into the canal rather than through the cortex of the mastoid. He further holds that there can be no necessity for this latter operation, so long as relief is obtained by evacuation of purulent matter from the mastoid region through the more natural channel of the tympanum.

"The lower mastoid cellules, when the seat of purulent inflammation, discharge into the antrum when the passage is unobstructed, otherwise through

the posterior wall of the external auditory canal, or the cortex of the mastoid process." From his observation, Dr. Sexton believes that perforative caries takes place in the former quite as often as in the latter situation. "In external periostitis the posterior wall of the canal is perhaps more frequently affected than the cortex of the mastoid process." Were there any indications to guide the surgeon in the detection of pent-up secretions in the cellules of the mastoid before a sinus had announced the fact, Dr. Sexton says he would not hesitate to perforate healthy tissues in order to relieve the patient; but he is unaware of such indications. Where an inflammatory process has caused destruction of the cortex of the mastoid, the sinus should be kept open, and even enlarged, by cutting or chiselling if necessary, remembering in such manipulations that the cranial fossa is only separated from the cellular structure by a more or less thin shell of bone. Special efforts to retain such an opening need not be made after drainage is established through the natural channel—the external auditory canal. Dr. Sexton has never been convinced that "any advantage accrues from any trephining operations which open up only the healthy cellular structure of the mastoid process, nor of the advantages, claimed by some writers, to have taken place on thus carrying a canal from the cortex into the dense hypertrophied mass produced by previous inflammation of the cellules."

Schwartz's indications for trephining the mastoid are considered in order, and rejected by Dr. Sexton as untenable.

"Of the first indication it cannot be admitted that 'œdema, pain, and fever' are pathognomonic of 'acute inflammation of the mastoid cells with retention of pus,' nor can the surgeon rely upon an incision over the mastoid, or in applications alone to relieve inflammation of the cellules, even though the above symptoms were accepted as pathognomonic of this condition."

"As regards the second indication, 'intermittent swelling,' it is of frequent occurrence where drainage from the tympanum is interrupted by the closure of a sinus from the cellules of the mastoid, or by clogging up of a tract of a dissecting tympano-mastoid abscess. It does not 'threaten life.'"

The third indication refers to matter seeking to escape from the cellules into the external auditory canal. Instead of liberating this where it presents, Schwartz proposes to establish an opening through the mastoid process. Here it is urged by him to operate "without hesitation" if "brain-symptoms" are noticed. In other words, if the symptoms are severe, open the mastoid cells for the liberation of purulent matter which is presenting on the superior wall of the external auditory canal." One of Dr. Sexton's cases, Case V., in the article under consideration, presented nearly all the so-called vital indications of Schwartz for opening the mastoid. "All of these symptoms, however, yielded upon the establishment of drainage through a free opening into the posterior superior wall of the canal where pointing was most prominent."

Schwartz's vital indication is based on "symptoms of brain-irritation" in chronic suppuration. "This is tantamount," in Dr. Sexton's opinion, "to recommending the trephining operation on the mastoid process for threatened pachymeningitis." Where periostitis interna is suspected of having reached the cellules, it has been Dr. Sexton's experience that drainage of the middle-ear tract can be best maintained through the natural channel of the tympanum, and adherence to this plan of treatment has never been attended with fatal results in his hands. "Trephining into the mastoid for threatened

pachymeningitis in this manner could only be regarded as warrantable surgery at an early stage, when unfortunately no sure pathognomonic symptoms are recognizable." The expressions "threaten life," "brain symptoms," "symptoms of cerebral irritation," and the like, are regarded as too frequently used in this connection, as untenable assumptions, and misleading, and, when accepted too confidently, as "tending to increase the importance of misconceived indications, rather than the establishment of sound surgical principles."

RECENTLY DESCRIBED ANATOMY OF THE EAR.

PROF. GRUBER, of Vienna (*Congress of Naturalists*, Berlin, September, 1886), has made some discoveries in the anatomy of the region of the round window. He shows that the prevailing view that the labyrinth has but two communications with the tympanic cavity, viz., by means of the round and the oval windows, is not correct. He then demonstrates that the vestibule and the upper passage in the cochlea have a further means of communication with the floor of the tympanic cavity, by means of a chink, which can be found in the niche of the round window. In fresh preparations this chink is filled by the beginning of the ductus cochlearis, which is covered below by the membrane lining the niche of the round window. A fine bristle can, in a normal specimen, be passed with ease from the niche of the round window into the vestibule, where it can be plainly seen after the removal of the stirrup bone from the oval window. The importance of this fact in its physiological, pathological, and therapeutic bearing, is dwelt upon, and it is claimed that, in a clinical sense, the niche of the round window should receive the greatest consideration.

PRIMARY DISEASE OF THE COCHLEA ENDING IN NECROSIS.

DR. TRAUTMANN, of Berlin (*Congress of Naturalists*, Berlin, September, 1886), has described a case of the above nature, the only analogue of which he has found described in Schwartz's book.¹ The patient, a man forty-five years old, was attacked, apparently, by violent meningitic symptoms. In six weeks a perforation of the membrana tympani occurred, granulations formed in the auditory canal, and, finally, the necrotic cochlea was thrown out. The malady ended in recovery, excepting that the face remained paralyzed, and the deafness was absolute.

AFFECTIONS OF THE LABYRINTH FROM CEREBRO-SPINAL MENINGITIS.

DR. STEINBRÜGGE, of Giessen (*Congress of Naturalists*, Berlin, September, 1886), gave an account of two cases of deafness due to cerebro-spinal meningitis, occurring in his own practice. One of these occurred suddenly; the other, more insidiously. The intra-labyrinthine structures are destroyed in this disease in a peculiar way, according to this observer. He claims that in this destructive process there may be distinguished two stages, viz., first the purulent inflammation, and then the necrotic process. The latter is the direct result of the action of the blood-poison upon the small vessels in the periosteum of the semicircular canals. The occurrence of stasis and thrombosis in these vessels is the cause of destruction of the periosteum and the membranous labyrinth-structures fastened to it. The necrosis, however, is not the result of the purulent inflammatory process, but is a primary process, and

¹ Lehrbuch der Chirurgischen Krankheiten des Ohres, p. 376.

thus are explained the early occurrence and irremediable persistence of deafness in many cases of cerebro-spinal meningitis.

Destruction of tissues by pus is chiefly accomplished mechanically, as soon as the latter has accumulated in considerable quantity. For example, it is shown that small masses of pus in the neighborhood of the facial nerve, and among its fibres, can occur without producing symptoms of paralysis; while larger quantities of pus, by pushing apart the fibres of the acoustic nerve seem to destroy it, as shown by one of Steinbrügge's cases. The new formations of connective tissue must be regarded as a more advanced stage of labyrinth disease.

Attention is called to the peculiar state of the temperature in cases of sporadic cerebro-spinal meningitis. Notwithstanding the purulent inflammation of the meninges, and the considerable labyrinthine destructions, the temperature may be only temporarily elevated, and then, for long intervals, entirely normal, when either recovery may take place, or a relapse with fatal issue may ensue.

In the discussion which followed, DR. BARTH, of Berlin, called attention to the fact that in meningitis consequent upon purulent otitis, the temperature may be normal or "subnormal," for one or two weeks before death, then suddenly, perhaps, at the moment of death, it rises. Therefore, if with this low temperature, the other symptoms do not improve, the prognosis must be very guarded, perhaps unfavorable. The question whether this phenomenon is due to irritation of a temperature centre, or to other causes, remains yet an open one. SCHWARZE, of Halle, stated that meningitis from otitis rarely proves fatal, without a temperature in excess of 38° C. (100.1° F.).—*Archiv f. Ohrenh.*, Bd. 24, S. 73, 1886.

PATHOLOGY OF OTITIS INTERNA.

HABERMANN, having made a post-mortem examination of the right temporal bone of a boy who died of cerebro-spinal meningitis, gives the following result of his investigation (*Zeitschrift f. Heilkunde*, Bd. 7, Prag, 1886, and *Archiv f. Ohrenheilk.*, Bd. 24, Nov. 1886). The membrana tympani was gray, dull, and flattened. The jugular fossa was deep, containing a blood-clot, to which there was attached a pale brown thrombus, 2.5 cm. long, which had originated in the inferior petrosal sinus. In the orifice of the aquæductus cochleæ, there was seen a plug of thick yellow pus, which extended further into the aqueduct. The acoustic nerve was pale, and the greater petrosal nerve was highly anæmic. The mucous membrane over the ossicles was somewhat thickened and pale. The floor of the tympanic cavity was very thin. The microscopic examination showed that the acoustic nerve in the inner auditory canal was surrounded by pus, and infiltrated with inflammatory products. Granulation tissue was discovered in the coarser trabeculæ of the endoneurium, and a similar, though less intense condition, was found in connection with the facial nerve. The fibres of the dura mater in the inner auditory canal were found infiltrated by inflammatory products, and the bone from this point was extensively softened, containing sinuses, between which were osteoblasts. The thin plate of bone which separates the vestibule from the internal auditory meatus was wanting, its place being occupied by infiltrated periosteum. The entire cavity of the cochlea was filled with

granulation tissue, which at some points had assumed the appearance and character of connective tissue, excepting the modiolus with the canalis ganglionaris, a part of the partition between the upper and middle passage, and some traces of the lamina spiralis, which were still present, but all the rest of the cochlear contents had been destroyed by suppuration. The aquæductus cochleæ toward the cranial cavity was filled with pus; toward the vestibular canal it was occupied by granulation tissue. The vestibule and the semi-circular canals were affected like the cochlea, the circular ligament about the oval window was partly destroyed by granulation tissue, and the membrane of the round window was thickened. The changes in the middle ear were only slight.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF
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THE JOURNAL OF LARYNGOLOGY AND RHINOLOGY.

English-reading physicians will heartily welcome a journal which, under the direction of DR. MORELL MACKENZIE, aims to give, in their vernacular, succinct but sufficiently full abstracts of whatever is worth knowing in current laryngological literature. Dr. R. Norris Wolfenden is associated in the editorial management, and the list of collaborators includes a number of well-known names, America being ably represented by Dr. J. N. Mackenzie, of Baltimore. The first number is a good one, and the journal will have the cordial wishes of the profession for its success.

THE LARYNGITIS OF TYPHOID FEVER.

DR. PAUL KOCH, of Luxembourg (*Contribution à l'étude du laryngo-typhus*), sums up the result of his studies and personal observation as follows:

1. There is a true laryngo-typhus. It always coincides with the acute period of the general malady.
2. If the symptoms of laryngeal stenosis become manifest during the period of convalescence from typhoid fever, they are the expression of the perichondritis which in general is manifested in acute maladies of long duration.
3. Operation is indicated as soon as the symptoms of laryngeal stenosis become disquieting.
4. Tracheotomy should always be performed low down, so as to avoid the cricoid region.
5. It requires patience to abandon these perilaryngites and perichondrites to their natural course, which is very long, without wishing to hasten definitive recovery.
6. If, after definitive recovery, the patient cannot dispense with the canula, there is plenty of time to employ mechanical treatment by the two routes open; and, should this not succeed, to practise a resection of a portion of the larynx.

The same author reports a case of laryngeal stricture consecutive to typhoid fever, cured nine years later by tracheotomy and incandescent destruction of an interfering fold of laryngeal mucous membrane.

SUBMUCOUS INJECTION OF LACTIC ACID IN LARYNGEAL TUBERCULOSIS.

DR. GEORGE W. MAJOR, of Montreal (*Canada Medical and Surgical Journal*, Dec. 1886), reports his favorable experience with this method of treatment, originated by Hering, of Warsaw, and subsequently adopted by Krause, of Berlin, who first introduced the superficial application of lactic acid into the therapeutics of tuberculosis of the larynx. The instrument employed is on the principle of the hypodermatic syringe, the needle being of proper length and curve to permit of ready manipulation. The strength of the solution employed varies from twenty to eighty per cent., the quantity injected being from five to ten minims. Should a slough form at the point of puncture, active treatment is to be suspended, but recourse may be had meanwhile to spray of a weaker solution. On separating, the slough leaves a healthy granulating surface, which completely heals in a few days. The method is especially efficacious in the early stages of the disease, that of submucous infiltration, characterized by the pyriform tumefaction of the aryteno-epiglottidean folds.

ECCHONDROSES AND EXOSTOSES OF THE LARYNX.

M. HENRY BERTOYE (Lyons), in a reprint from the *Annales des mal. de l'oreille et du lar.*, collates recorded cases and adds a personal observation. His patient was a man, forty-two years of age, who died of pulmonary complications seven days after tracheotomy. The tumor, which occupied nearly the entire right side of the internal face of the cricoid cartilage, was hemispherical in shape, and histologically resembled hyaline cartilage undergoing ossific change.

PEROXIDE OF HYDROGEN IN WHOOPING-COUGH.

DR. B. W. RICHARDSON (*Asclepiad*, No. 13) has treated nine cases of whooping-cough, six males and three females, with peroxide of hydrogen exclusively; giving a fluidrachm of the ten volume solution five or six times daily. He has not seen equally good results from any other treatment, except change of air. He uses the following formula:

"Hydrogen peroxide (10 vols. strength)	. . .	3vj.
Glycerine, pure	. . .	3iv.
Water, distilled	. . .	to 3iij.—Mix.

To make a solution of three fluidounces, of which let half a fluidounce be taken in a wine-glass of water, as directed."

When there is stridulous spasm, he substitutes ozonic ether, 3ij, for the solution of the peroxide, or adds it to the mixture.

EPILEPTIFORM SEIZURES FROM POST-NASAL POLYPUS.

To the few instances on record of convulsions apparently epileptic, due to reflex irritation from nasal polypi, is to be added a case reported by DR. B. W. RICHARDSON, in the *Asclepiad*, No. 13, 1887. A married lady,

aged thirty-four, not at all hysterical, who had been unsuccessfully treated for epilepsy, stated that the cause of the attacks seemed to be in the back of the throat, and to be produced by something that dropped into the larynx, as when one "swallows the wrong way." Nothing abnormal was found in the larynx, but while the mirror was in the throat a large drop of fluid fell from the post-nasal cavity. Examination being thus directed to the nose, a polyp was discovered, and removed entire with forceps. It was a large fluid gelatinous mass, the size of a large walnut. When gently pressed, drops of gelatinous fluid exuded. For eight years there has been no recurrence of the growth, or of the epileptiform seizures.

LOCAL TREATMENT OF ACUTE SUPPURATION IN THE MAXILLARY SINUS.

PROF. STOERK, of Vienna (*Wien. med. Woch.*, No. 43, 1886), recommends the use of a syringe, with a delicate tubular nozzle, to be introduced into the nasal outlet of the sinus, so that the sinus can be thoroughly syringed; a method which he has found preferable to all others. When the tumefaction of the nasal mucous membrane is too great for this procedure, Stoerk merely attempts to reach the vicinity of the opening with the extremity of the syringe, trusting to the sensations of the patient to indicate the moment in which the stream of liquid enters the sinus, and then makes marks on the instrument to facilitate subsequent manipulations. Medicaments should be applied warm, as a rule, and in weak solution; for example, no stronger than a one or two per cent. solution of silver nitrate.

STRICTURE OF THE ŒSOPHAGUS.

Successful graduated dilatation of a stricture, from deglutition of concentrated lye, in a child two years of age, is reported by DR. WALKER SCHELL, in the *Indiana Medical Journal*.

DR. MCPHEDRAN, of Toronto (*Med. News*, Feb. 12, 1887, p. 191), performed gastrostomy in a woman, aged forty-one, for malignant stricture of the œsophagus, the patient surviving six months and eighteen days.

GASTROTOMY AND DIGITAL EXTRACTION OF A FOREIGN BODY FROM THE ŒSOPHAGUS.

DR. MAURICE H. RICHARDSON (*Boston Med. and Surg. Journ.*, Dec. 16, 1886), on August 5, 1886, performed gastrotomy, and, inserting his hand and forearm through the wound, succeeded in withdrawing a plate of false teeth from its lodgement in the œsophagus. Under antiseptic treatment, recovery was complete on the 25th of October, the patient returning to his work as a teamster.

INFLUENCE OF ETHER UPON THE MUSCLES OF THE LARYNX.

DRS. SEMON and HORSLEY (*Brit. Med. Journ.*, August and September, 1886) have made an important investigation upon the differential action of ether and of electric currents of various strength upon the abductor and adductor muscles; following the researches of HOOPER and of DONALDSON, Jr. As the whole subject is reviewed in PROF. BOWDITCH's paper in the present number of this journal, no more than the simple record is needed in this place.

DERMATOLOGY.

 UNDER THE CHARGE OF

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 LANOLIN.

LIEBREICH (*Deutsche medicinische Wochenschrift*, No. 28, 1886) directs attention to several important points regarding lanolin. Its keeping qualities, as well as its non-irritating properties, depend upon the thorough elimination of its free fatty acids. In the crude wool-fat these acids are present in the proportion of twenty to thirty per cent. Analyses of the different preparations of lanolin (wool-fat plus a proportion of water) on the market disclose wide differences in this respect; that by one pharmacist being practically free from the fatty acids, while in that of another, doubtless on account of partial elimination of the neutral wool-fat, these acids are found present in greater proportion than occurs in the crude wool-fat; in the others the percentage varies between these two extremes. The following are the actual results: Heiner's, 23.24 per cent.; Merck's, 12.23 per cent.; Riedel's, 11.12 per cent.; Jaffé & Darmstädter's, 0.05-0.5 per cent. In the lately introduced lanolinum anhydricum the following percentage: Heiner's, 33 per cent.; Metcalf & Co.'s (agnine), 26.8 per cent.; Merck's, 17.5 per cent.; Eisner & Mendelsohn's, 16.98 per cent.; Riedel's, 16.65 per cent.; Jaffé & Darmstädter's, 0.5-1 per cent.

In ointments containing considerable powder, and also in those containing chemicals which are apt to undergo change when in intimate contact with water, lanolinum anhydricum is to be preferred as the base; also in those ointments, in the preparation of which heat is required. In other instances the ordinary lanolin may be employed. In general, it may be stated that ointments made with the ordinary lanolin are stiffer than those made with lanolinum anhydricum.

SCHWENINGER (*Charité-Annalen*, xi., Jahrg., 1886) gives his experience with lanolin, having treated about two hundred cases of skin disease at the dermatological clinic of the Charité Hospital in Berlin with this remedy. Where practicable, and where the disease was symmetrical, one side of the body was treated with lanolin ointment and the other side with various fats, glycerine, and vaseline ointments. In all cases, without exception, the results were in favor of lanolin. It is to be especially recommended for the relief of thickened, scaly conditions, roughness of the epidermis, eczema, psoriasis, pityriasis, prurigo, and ichthyosis. Moreover, the lanolin preparations are useful where a penetrating action (as in syphilis) is desirable, and where thickened epidermic layers are to be relieved.

LICHEN RUBER.

CÆSAR BÖCK discusses lichen ruber in Norway (*Monatshefte für prak. Dermatologie*, October, 1886), more especially in Christiania, where, as in Northern Germany, the disease is of infrequent occurrence, the author having encountered only seven cases during a period of eleven years. Both varieties of the disease—the acuminate and the plane—were met with, but more frequently the plane. In two cases the acuminate was combined with the plane, but the former was in no instance found to exist alone. The subjects were all in good circumstances, an observation which has been on more than one occasion noted concerning the etiology of this affection by other reporters of cases. Böck considers that the so-called lichen ruber (Hebra) and lichen planus (Wilson), constituting respectively the acuminate and plane varieties of the lichen ruber of most authors, are one and the same disease, a view which is in opposition to the opinion of Robinson, of New York, who regards a slightly developed horny layer of the epidermis as characteristic of lichen planus. Böck finds that this layer, although often variable in its development, is, as a rule, strongly marked, which, he adds, is in accord with clinical observation. All the cases reported were of a mild type, though two had existed thirteen and twenty-six years. The author observes that the disease pursues a variable course in different countries, concerning which point there seems to be no doubt.

RARE FORMS OF IODIDE ERUPTION.

JANOWSKY (*Monatshefte für prak. Dermatologie*, October, 1886) gives three cases of rare forms of iodide eruption. The first is that of a man, the subject of syphilis, aged fifty, and is similar to one reported by Morrow, of New York. The face was involved, and the affection was characterized by febrile symptoms, swelling, and an eruption of distended, clear vesicles of variable size. The mucous membrane of the mouth was also invaded. In the course of a few days the eruption became crusted and eczematous in appearance. Iodide of potassium was found in the urine and also in the vesicles. The efflorescence appeared on the second day, after only thirty grains had been taken, and was the second time the patient had suffered from the cutaneous manifestation. The second case was that of a syphilitic woman, the lesions being hemorrhagic, of the form of purpura, and involved the lower extremities. Similar cases are reported by Fox and by Thin. The third case occurred in a syphilitic man, forty-six years of age, the cutaneous lesions resembling erythema nodosum, but lacking the bluish tints. The urine contained iodine. The disease was produced a second time by again using the iodide after the first attack had passed off. The author regards this case as being like those described by Pellizzari a few years ago, and inclines to this observer's view of the specific action of iodine on the vascular system. It has been repeatedly shown that the extent of the eruption bears no relation to the amount of the medicine used.

ICHTHYOL.

In the *Chicago Medical Journal* for December, 1886, ZEISLER reports his experience with ichthyol. Externally, in all forms of eczema it proved use-

ful, the result in all but a few cases being favorable; according to the degree of acuteness, the remedy should be applied in the proportion varying from five to thirty per cent. In sycosis its effects were good in a majority of the cases; it was employed in the form of a ten per cent. ointment, in conjunction with a soap of ichthyol. In acne vulgaris the results were not positive. In acne rosacea its favorable influence was undoubted.

Internally, the remedy was given in about twenty-five cases, in doses varying from three to fifteen grains thrice daily. In general, as the author states from his limited experience, it may be said that in all cases in which the rheumatic diathesis and dyspeptic ailments may be considered etiological factors ichthyol will have indirectly a favorable influence by removing these conditions. Independently of such predisposing causes, however, it acted well, in the author's experience, in a few cases of acne and acne rosacea in which it was prescribed. Possibly in some instances it may act, as suggested by Unna, by its contracting effects upon the cutaneous capillaries.

PROF. SCHWENINGER (*Charité-Annalen*, xi., Jahrg. 1886) has, since 1883, employed ichthyol, chiefly in from ten to fifty per cent. solutions, in rheumatism, lumbago, neuralgias, gout, and migraine, and finds that in relieving the pains accompanying these diseases it acts better than any other known medicament. It also proved useful in the treatment of open wounds and in gangrenous sores, applied on cloths or lint, and relieved pain about as effectually as the other well-known remedies. In chronic eczema a ten per cent. ointment with oxide of zinc was employed, and in keratoses, where the epidermis had been previously removed by maceration and soap, it was found to cause healing rapidly. Internally, in the form of capsules, containing ten per cent. solutions in ether, alcohol, glycerine, or water, it also proved valuable in various skin diseases, malaria, and East Indian fever.

IMPORTANCE OF THE USE OF THE ABSOLUTE GALVANOMETER IN THE DESTRUCTION OF SUPERFLUOUS HAIR BY ELECTROLYSIS.

In a recent number (November 4, 1886) of the *Boston Medical and Surgical Journal*, PRINCE contributes some practical points to the subject of the removal of hair by electrolysis. The great desideratum is to effect the destruction of the papillæ without the production of scarring. In a certain percentage of cases this untoward result has been recognized by all observers as practically inevitable, and has been considered due to individual peculiarity of the skin. Prince is of the opinion, however, that such a result is more probably caused by the use of too strong a current. The great variability in the strength of the current from the same number of cells, not only in different batteries but under varying conditions in the same battery, is well known, and hence the customary statement to use a certain number of cells is unscientific, and not without its dangers as relates to the matter of scarring. Another gauge usually advised is the occurrence of effervescence about the outlet of the follicles; but this is equally unscientific as this does not always show itself, and moreover the destruction of the papillæ may be effected with less chemical action than implied by effervescence.

All precautions should be taken toward avoiding variability in the current;

for instance, instead of the sponge electrode, with which the current is weaker or stronger according to the degree of compression made, the positive electrode should consist of a metallic plate, covered either with chamois or a layer of absorbent cotton and fastened to the forearm. This being the case, there should, of course, be an arrangement by which the current at the positive side could be broken before the needle is withdrawn. A suitable galvanometer, such as the author describes, permits thorough control of the battery, and the strength of the current may be readily measured. A current of one milliampère, passing two or three seconds, the author finds most satisfactory; it never should exceed two milliampères. If the papilla is not destroyed in the time stated, the fault lies with the introduction of the needle—the failure to strike the papilla. During the sitting constant attention should be given to the galvanometer, in order that the current may be kept at a uniform strength.

THE TREATMENT OF HYPERTRICHOSIS.

KAREWSKI, in a paper (*Deutsche medicinische Wochenschrift*, No. 34, 1886) on this subject, discusses the now well-known method by electrolysis and a new method by the galvano-cautery. The author's experience with electrolysis has been such as to confirm its practicability and efficacy. An interesting point is his statement that there is practically no difference in the results, whether the needle is attached to the negative or to the positive pole, as at both poles disintegration will take place. If, however, the needle is attached to the positive electrode, it is necessary that it should be one of platinum or platino-iridium; with a steel needle oxidization occurs, the oxide of iron is left in the follicle, and a permanent pigment-speck remains. In regard to the method by galvano-cautery, the author speaks equally favorably. A suitable handle is required, to which is attached a properly constructed needle. This latter consists of two platinum wires which are welded together at one end and ground to form a needle as fine in calibre as that commonly employed in electrolysis. The two free ends are attached to the handle, one connecting with the positive electrode and the other with the negative. When the battery is put in action the needle becomes heated to a white heat, and is then ready for the operation. (In the original paper a descriptive cut is given of both the needle and handle.—Eds.) The procedure is, in its further steps, somewhat similar to that of electrolysis.

The author sums up his experience with both methods as follows: 1. Both the galvano-cautery and electrolysis are adapted for the permanent removal of superfluous hair. 2. Both accomplish the purpose, with few exceptions, without perceptible scarring. 3. The galvano-cautery is more rapid and less painful, but the operation is, for the days immediately following it, more disfiguring.

THE ANATOMY OF KELOID IN ITS EARLY STAGE.

An opportunity was offered CROCKER (*British Medical Journal*, September 18, 1886) of studying the anatomy of a keloidal formation, arising from a scar, of less than a month's growth. Histologically the tumor was found, even at this early stage, to differ but slightly from similar growths at a more advanced period, except that there still remained an abundance of cells and

nuclei, and as yet very few, if any, of the bloodvessels had been obliterated and changed into fibrous bands, as is known to happen as the tumor develops, especially in the central portions. The author considers the division of keloid into two classes—true and false—to be without anatomical or clinical foundation. An interesting and practical point evolved, confirmatory of Warren's observations, is that the bloodvessels are affected far beyond the tumor. The value of this observation is obvious, as in those cases in which interference is deemed advisable, it is essential, if a recurrence is to be avoided, to cut wide of the growth in order to get beyond the diseased vessels. The tumor, the investigation of which formed the basis of this paper, was treated in this manner, and four months later there had been no sign of a return.

A CONTRIBUTION TO THE CLINICAL STUDY OF SCLERODERMA.

The notes of two cases of this disease are given (*Journal of Cutaneous and Venereal Diseases*, November, 1886) by GRAHAM. In one, a woman, aged forty-seven, the affection, which involved the whole surface, ran its course in ten months, ending in complete recovery. There was at no time œdema, and there was but slight pigmentation, and this limited to the back of the neck and the upper lip. In the second case, a male, aged thirty-nine, the disease involved the trunk and limbs with considerable pigmentation and, in the beginning, œdema. Up to the time of report it had shown no marked change for the better. In both of these cases there was a family history of rheumatism, although in neither had the patient suffered from the ordinary phenomena of this disease. From a study, symptomatically and pathologically, of the disease, based upon cases afforded by the literature and his own experience, the author is led to look upon it as a manifestation of the rheumatic diathesis, and, in view of this conclusion, advises the employment of anti-rheumatic remedies, such as potassium iodide, salicylate of sodium, etc., and, externally, baths, friction with oil, and the like. The author shares the view of several other observers in stating that there are two forms of the disease—acute and chronic; his first case representing the acute type and the second case the chronic form. In regard to the relationship of scleroderma to morphœa, Graham inclines to the belief that they are closely allied, but for the present it is inadvisable to class them as one disease.

A CASE OF EXFOLIATIVE DERMATITIS (PITYRIASIS RUBRA?) WITH BULLOUS LESIONS.

In the *Journal of Cutaneous and Venereal Diseases* for November, 1886, HARDAWAY reports a case in the course of which to the ordinary symptoms of pityriasis rubra was added, for a period of a week or ten days, the presence of bullous lesions. These appeared in crops of a dozen or less, and were scattered irregularly over the general surface. Each crop was preceded by a chill, with subsequent slight elevation of the temperature; but there was no regularity in their appearance. This anomalous formation then disappeared, and subsequently, at least so long as the case was under observation, the usual symptoms of pityriasis rubra were noted.

TWO CASES OF LUPUS TREATED SUCCESSFULLY WITH IODOFORM.

TYRRELL reports (*British Medical Journal*, October 30, 1886) briefly two cases of lupus vulgaris involving the nose and upper lip, in which the local treatment consisted solely of the application of iodoform in the form of an ointment (a drachm of iodoform to the ounce of vaseline). Cod-liver oil was prescribed in both cases. The parts soon assumed a healthy appearance, healing gradually but uninterruptedly; in one case a cure resulting in six months, and in the other in four to five months.

PASTES IN CUTANEOUS THERAPEUTICS.

According to MARTIN'S experience (*Deutsche medicinische Wochenschrift*, December 30, 1886), better results follow the treatment of inflammatory skin diseases, especially those of an eczematous type, by means of pastes than are to be secured by other methods. What is commonly known as Lassar's paste—Ac. salicylici, gr. x; pulv. zinci oxidi, pulv. amyli, āā ʒij; vaselin, ʒij—was employed in the author's cases. It may be advantageously used in all forms of eczema. Where the parts affected permitted—as, for example, about the hands, arms, legs, etc.—the skin, after a thorough soap and water washing, is coated over with a thick layer of the paste, this covered with a thin film of clean cotton, and then a bandage of gauze applied. This dressing may remain on for several days, and in some instances even a week or longer. Rarely more than the repetition of three such dressings is necessary for a cure. When the eczema is upon the face, for obvious reasons the above method of application is impracticable, and the paste is, therefore, simply smeared on at frequent intervals. About the angles of the ears and nose, after applying the paste, a small thin film of cotton may be stuck on over it with better effect.

MYCOSIS FUNGOIDES.

KÖBNER presents (*Deutsche medicinische Wochenschrift*, Nos. 39 and 40, 1886) the results of a careful study of this curious affection, based upon clinical observation and an analysis of the literature of the subject. Two cases are reported in full; in one of which the type was mild, and under increasing doses of arsenic recovery took place (two and a half years later there had been no reappearance of the disease); in the other case, the disease followed the usual course, a fatal result ensuing a few years after its first appearance.

Clinically there seem to be two varieties of the disease. In one, which the author's first case represents, the disease is usually more localized, being confined to several regions; the tumors are not so liable to sudden appearance and disappearance, are of slow growth, and there is no disturbance of the general health. There is always, however, the usual premonitory stage of red, eczema-like patches or superficial infiltration. This variety is apparently susceptible of relief by the arsenical treatment.

The second variety is more frequently observed. Its course may be divided into four stages. The first stage shows only erythematous patches or scattered eczematous lesions, and occasionally urticaria-like eruption. This may last from one to two years (and rarely as happened in the author's second

case, entirely disappear), when the second stage, which may appropriately be called the period of (flat) infiltration, begins. These lesions which are flat or semi-globular, bright or vermilion-red, exceedingly itchy, soft to tolerably tough, covered with a tense and shiny epiderm, may disappear entirely in one place and a new and similar growth appear in other regions, going through the same stages. In some of these growths the centre only is absorbed and there remains a peripheral desquamating wall. After some months, by additional growth or confluence of such infiltrations, or from an eczematous basis, or less frequently from an area of skin previously involved and healed, or from apparently sound skin, appear the peculiar, knobby, polymorphous tumors, ragged or furrowed, dark red, in appearance not unlike a tomato or mushroom. In this, the third stage, the growths may in a short time, individually or through confluence, become the size of an orange or larger, and rarely a tumor may become pedunculated. Itching persists, and there is a constant serous discharge, which, with the exfoliating epiderm, gives rise to crusts. Even in this stage individual tumors may disappear by absorption without leaving a trace. At this time also superficial ulceration of the growths is noted, from which oozes a considerable amount of serum and thin pus, which rapidly undergoes decomposition, and, in spite of antiseptic applications, gives rise to a fetid odor. Only after months does the general health begin to suffer, exhaustion being gradually induced through loss of sleep in consequence of the intense itching, and from the constant serous and purulent discharge. In this way the disease gradually goes into the fourth stage—the stage of cachexia, in which, in addition to superficial ulceration, the growths may be the seat of deep-seated, crateriform ulcers; in fact, there may be a complete slough of individual tumors, the destructive process extending, in some instances, through to the periosteum. In some cases the growths may appear on the mucous membranes. Wasting diarrhœa, frequent chills, with increased temperature, which are often met with in this stage and hasten the end, may be looked upon usually as symptoms of septicæmia. The usual complications which lead to a rapidly fatal issue are, above all, pneumonia and pleuritis, with rapid effusion; less frequently nephritis and uræmia. According to published cases, an unquestionable example of metastasis to internal organs has not been observed.

Briefly stated, there was found, microscopically, infiltration of the corium, made up of large, mainly round, and to a less extent ovoid, single-nucleated cells lying between the greatly separated connective-tissue fibres; the cell infiltration, in the middle of the markedly developed growths, was so great as essentially to destroy all traces of these fibrillæ. Between the cell masses were seen scattered large cells containing several nuclei, variously shaped "Mastzellen," and, especially near the lower border of the infiltration, remarkably large spindle-shaped cells, filled with finely and coarsely granular protoplasm. In recent growths could be seen the cell accumulations beginning around the subpapillary, superficial vessels of the corium, and extending upward along the papillary branches to the corneous layer, which is finally broken through and ulceration results. In the rete were seen many wandering cells, and here, as likewise in the papillæ, branching brownish pigment cells. The bacterial investigation, carefully made, gave negative results.

The author contends, both from the anatomical data and the clinical course

of the disease, and especially from the fact that the tumors may undergo spontaneous involution, that the view which classes it as a sarcoma or related disease is erroneous; and states that if the affection in its entire course be studied clinically and histologically, this becomes evident. His own view is that it is a typical chronic infective disease, and that Bazin's view of its analogy to leprosy has much evidence in its favor.

IMPETIGO CONTAGIOSA.

A paper on this disease is contributed (*Daniel's Texas Medical Journal*, August, 1886) by BEALL. His experience embraces twenty-four cases. Clinically the cases illustrated the disease as ordinarily described. A peculiarity, in a few of the cases, in the separation of some of the crusts from the underlying skin was noticed—detachment beginning at the centre and progressing centrifugally. When this occurred the maculation showing the site of the lesion, and which persists for some time afterward, displayed different degrees of intensity in concentric rings—the darkest at the periphery, and the lightest at the centre. This peculiarity, when present, the writer thinks may be considered pathognomonic. At the time of observation of the first group of cases, smallpox was prevalent, and hence vaccination largely practised, and in these cases there may have been some relationship between that operation and the contagious impetigo; in the group of cases recently observed, however, no relationship was demonstrable. In examination of the crust a peculiar microorganism was discovered, to which, in the author's judgment, the disease is to be attributed. The same organism was subsequently found also in the fluid of a matured vesicle. The crust was treated with a three per cent. solution of pure caustic potash, then stained with eosin, and mounted in glycerine. The examinations were made with a one-fifth Gundlach objective, D eye-piece, and amplifying tube. Differentiation was facilitated by staining. In the microscopic field could be seen epithelium, scattered oil globules, and crystals of margarine, and numerous minute, round, and oval bodies. These last, the microorganisms, were constant, and "in all probability the direct factor in the etiology of the disease." These organisms, under white light, were colorless, highly refractive, spheroidal and ovoidal, and $\frac{1}{8000}$ to $\frac{1}{5000}$ of an inch in diameter, and scattered through the field singly or in pairs.

MIDWIFERY AND GYNECOLOGY.

UNDER THE CHARGE OF

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THE DESIRABILITY OF THE EARLY PERFORMANCE OF LAPAROTOMY IN CASES OF ABDOMINAL PREGNANCY.

LUSK (*Brit. Med. Journal*, December 4, 1886) first narrates his case, which is briefly as follows:

Mrs. B., æt. thirty-five, menstruated regularly until the end of October, 1883. On Oct. 24th of the same year, and also on Nov. 6th and 7th, she had

severe attacks of pain referred to the right side, but radiating over the abdomen. Pregnancy was diagnosticated, and confinement expected in July, 1884. On July 17th there was some vaginal discharge, a few pains, but no other signs of labor. Doubt was now cast on the supposition of pregnancy, one consultant alleging it was cystofibroma of the posterior uterine wall. The tumor diminished after the death of the fœtus, and was considered an abdominal pregnancy by Drs. Fordyce Barker, Thomas, and Lusk, who were now consulted. Operation was advised by them should dangerous symptoms arise, but was put off on other advice, until her strength was reduced by diarrhœa and septic mischief. In March, 1886, the condition was serious: pulse rapid, temperature 104° F., great emaciation and anæmia. Operation was performed on March 19th, as follows: After a median incision below the navel, the sac, non-adherent to the abdominal walls, was opened. Colorless water and fetid gas escaped, and then a macerated shrunken fœtus was removed, but no trace of placenta or cord could be found. The edges of the sac were stitched to the abdominal wound, free stimulation employed, but the patient sank forty hours afterward. On post-mortem it seemed as if the ovum had developed in the fimbriated end of the Fallopian tube.

Lusk adds four tables of cases as an aid to settling the point of early operation or not. In Table I. there are 29 cases of abdominal pregnancy, ending in fistulous openings; of these 9 died, and many of the remainder can hardly be dignified with the term "recovery." In Table II. 8 cases are given where death occurred before fistulæ formed. In Tables III. and IV. there are collected 52 cases of laparotomy (secondary) for abdominal pregnancy, with a mortality of 15, and recovery of 37. This does not give a fair picture of what might have been done, as in only 3 of the 15 could the operation be charged with the fatal result. In Table V. 11 cases of primary operation are recorded, with two maternal recoveries, and two children saved. Lusk is cautious in his conclusions, but recommends primary laparotomy and improvement in the technique of secondary laparotomy in the direction of earlier operation and entire removal of the sac.

The following few cases illustrate the moot question of the treatment of early tubal pregnancy:

LAWSON TAIT (*Brit. Gynec. Journ.*, November, 1886) showed a preparation of tubal pregnancy removed after rupture of the sac. The patient was so collapsed that operation had to be delayed for some hours until the use of stimulants and hot-water bottles brought on reaction. The left tube was then removed by laparotomy, and a large quantity of blood removed. Recovery was uninterrupted.

HART (*Brit. Med. Journ.*, December 4, 1886) records a similar successful case.

MUNDÉ (*Am. Journ. of Obstetrics*, January, 1887) showed at the New York Obstetrical Society a specimen of tubal pregnancy. The patient was admitted into hospital with the history of sudden violent pains, and collapse occurring the day before. The pulse was 120, respiration 24, and abdomen tympanitic. From this, and the fact that the patient had menstruated six weeks before, rupture of a Fallopian tube and pregnancy were diagnosticated. The usual palliative treatment was employed, but the patient suddenly collapsed in a few days. On post-mortem, a tubal gestation firmly adherent in Douglas's pouch, was discovered with a slight rent on its posterior surface.

The pathologist expressed his opinion that it would have been impossible to arrest the hemorrhages by laparotomy. In the discussion on this specimen, Dr. Janvrin related a case where, after recovery from partial rupture, he applied galvanism to destroy the fœtus. The morning after the third séance, nine days after the first hemorrhage, the patient was seized with tremendous bleeding, and died in forty hours. On post-mortem, a slight rupture, involving a small artery, was found, as well as a second and more complete rupture at the same point.

CASE OF EXTRA-UTERINE GESTATION ARRESTED BY ELECTRICITY.

DR. AVELING's case (*Brit. Med. Journ.*, December 4, 1886) had the ordinary symptoms and signs of extra-uterine gestation, viz., suppression of menstruation, occasional severe colicky pains, expulsion of portions of decidua, and, finally, at the third and fourth months, a retro-uterine tumor steadily increasing in size. Dr. Aveling applied the interrupted current, the negative pole over the swelling felt through the vaginal roof, the positive over the abdominal wall. Each application lasted ten minutes, and after four such, made on consecutive days, great improvement took place, the tumor becoming decidedly smaller and pain lessening. In two months the swelling, originally the size of a man's fist, could be felt only as a small elongate body.

EXTRA-UTERINE GESTATION TREATED BY GALVANIC PUNCTURE.

DR. PETCH (*Brit. Med. Journ.*, December 4, 1886) used the galvanic current in his case passing insulated needles into the tumor. A Leclanché battery was used and the current of thirty cells allowed to pass for an hour.

In Dr. Petch's case the gestation had gone on beyond the fifth month as fœtal heart sounds were heard, and fœtal movements felt by the patient. The day after the current was used, the heart sounds were feeble and in three days could not be heard. Twelve months afterward the tumor was the size of a cocoanut, and in three years it had disappeared.

In this case the galvanic current was used "from consideration of its well-known chemical effects in the coagulation and decomposition of albuminous tissues, and its power of splitting up both organic and inorganic substances into various absorbable products."

The following facts should be remembered in connection with the use of electricity in early extrauterine gestation.

1. The placenta may grow after the fœtus is dead.
2. Manipulation of the uterus, such as passing a sound into it, may cause rupture of the sac.
3. The dead fœtus may not be absorbed.
4. Diagnosis is doubtful in some cases.

CASE OF FORCIBLE TEARING OUT OF THE UTERUS, AND COMPLETE DESTRUCTION OF THE RECTO-VAGINAL SEPTUM; RECOVERY.

SCHMALFUSS reports (*Centralbl. für Gynäk.*, No. 46, 1886) an interesting medico-legal case, showing the tolerance of the female pelvic organs to the most violent injury.

M. B., forty years of age, was brought by the police to the Infirmary. The history given was as follows: The patient had been drinking with two workmen, who afterward had connection with her consent. She then felt great

pain in the lower part of the abdomen, and became unconscious. Fourteen hours elapsed before she was attended to medically, when the following was found to be her state:

She was stupid looking, clothes covered with mud and blood, and in some respects looked like a woman who had been confined. The pulse was feeble, easily compressible, but not specially bad; sensorium clear; no fever and no pain, except a burning in the lower part of the abdomen. On local examination, a fleshy lump was noted protruding from the introitus vaginæ; it was covered with clots and mud, and at first sight looked like an expelled placenta. When cleansed, however, it was discovered to be the uterus torn from its attachments, and brought outside the vaginal entrance, so that the os looked to the anterior vaginal wall, and the fundus to the ground. The whole recto-vaginal septum was torn through, and the uterus retained only by the remaining part of the anterior vaginal wall and the left ligaments. At the lateral angles of the uterus one could see parts of the round ligaments, the tubes, and the broad ligaments, and at the fundus and posterior wall false membranes; the ovaries were not in sight, and the bladder and urethra were uninjured. There was no bleeding. The bladder was allowed to remain full, so as to prevent any further prolapse of abdominal contents.

The treatment adopted was as follows: The uterus was severed from its remaining attachments, elastic ligatures being employed. The lacerated portions of the vagina and septum were removed, the cloaca washed out with corrosive sublimate (1:5000), and plugged with iodoform gauze. The patient recovered, and when examined on the twenty-first day had the following local condition: A deep cloaca was present, whose anterior and antero-lateral walls were vaginal, the posterior and postero-lateral being rectal mucous membrane. Bridges of granulation tissue lay between. By two plastic operations the recto-vaginal septum and sphincter ani were restored.

This injury had evidently been caused by the perpetrator passing his hand into the rectum, seizing the uterus, and forcibly dragging it out, the recto-vaginal wall being necessarily torn. The full bladder, fainting of the patient, and the old uterine adhesions, helped to render the injury so far harmless.

CURE OF SEVERE PUERPERAL DISEASE BY AMPUTATION OF THE SEPTIC CORPUS UTERI.

SCHULTZE, of Jena (*Deutsche med. Woch.*, Nov. 4, 1886), records here a remarkable case where he amputated a bicornuous uterus for retention of the placenta in the pregnant horn and septic infection.

F. S., twenty-one years of age, had, in the seventh month of pregnancy, a dead child born (Sept. 7). The placenta was retained, and the midwife, in her attempts to remove it, tore away the cord. Some time afterward the medical man who was summoned found the cervix of the double uterus so narrow that he was unable to reach the placenta. Expression was of no effect. She was then taken into hospital, and on the following day the same difficulty felt. Hot baths, the constant current, and deep narcosis had no influence on the calibre of the canal, which scarcely admitted a finger.

On the 9th the evening temperature was 39.9° C., and there were rigors, with putrid discharge.

On the 10th examination under deep narcosis was again had recourse to, and a stricture admitting the finger found in the right horn. The left horn was empty. In the right the placenta was found adherent, and a small stinking piece was removed. On the 11th the temperature was 40.1° C., and there were rigors and beginning peritoneal disturbance. Laparotomy was therefore performed on the morning of the 13th (sixth day of puerperium). Schultze had before him three courses, viz., to do a conservative Cæsarean section, removing the placenta only, or if necessary to remove the horn with the placenta; most probably he considered the amputation of both horns would be required. The incision from navel to symphysis was made in the middle line, the uterus turned out with the hand, an elastic ligature applied, the uterus incised, and the stinking placenta removed. The uterine wall was found to be rotten, the putridity extending to 2 mm. below the peritoneal reflexion. As the left horn was also discolored, amputation of both horns was imperative. There was an exudation in the pelvis. The infundibulo-pelvic ligaments (of the ovary) were found so short that a pure Porro's operation could not be carried out. These ligaments, therefore, were tied and divided, the uterus and ovaries brought out, and any part of the broad ligament gaping between the elastic tube and the ligatures stitched with a running catgut suture. It was evidently impossible to treat the pedicle by Schröder's method for fibroids, as pus could be squeezed out of the lymphatics of the stump; it was therefore fastened in the abdominal incision according to Hegar's method, the peritoneum stitched to it below the elastic tube, the surface of the stump seared, and afterward chloride of zinc applied. The temperature soon fell, and on the ninth day the seared portion of the stump was removed with scissors.

Schultze finally lays down the following indications for such interference, viz., the mischief must be in the uterus, and the possibility of septic thrombosis and embolism elsewhere must be excluded. [In a case of pregnancy in the horn of a double uterus which I saw in consultation, the labor came on at the seventh month, the placenta was adherent and removed with difficulty, and only after deep narcosis, owing to marked spasm of the contraction ring. The patient made a bad recovery.]

INGLEBY LECTURES ON ABDOMINAL SURGERY.

MR. TAIT records (*Medical Press and Circular*, Nos. 20 and 21, 1886), *inter alia*, a case where he performed abdominal section for puerperal peritonitis. The patient was under Dr. Lycett's care, and had a severe operative labor. On the third day acute peritonitis appeared in the right iliac region, and soon became general. There was great distention on the fifth day, pulse 135, hic-cough, and incessant vomiting. Next day, when seen by Mr. Tait, the pulse was uncountable, and bilious vomiting present.

On abdominal section the mischief was found in the right iliac fossa, where the uterus was fixed to the pelvic brim. Bloody purulent fluid was evacuated after the adhesions were broken down: a glass drainage tube was passed deep into the pelvis, and the wound closed. The pulse soon fell, vomiting ceased at once, and the patient recovered.

ACUTE PERITONITIS; OPERATION AND RECOVERY.

DR. J. W. TAYLOR records (*British Medical Journal*, December 18, 1886) a case of abdominal section for general peritonitis caused by rupture of an abscess of the ovary. The patient was attended during labor (September 29, 1886) by Dr. Phillips, and had forceps applied for uterine inertia. On the third day she had pain in the left iliac region, and up till the end of October had intermittent feverish attacks, with pain and tenderness there. On November 11th she was seized with sudden pain and vomiting. Next day her temperature was 104° F., pulse 100. The abdomen was distended and tender, and an ill-defined swelling could be made out behind the uterus on vaginal examination.

Abdominal section was performed on November 14th, when sero-purulent fluid was found in the abdomen and pelvis. The left uterine appendages, intestines, and omentum were matted, but ultimately the Fallopian tube and ovary were isolated and brought up. The ovary was then found to contain an abscess, which had burst by two ulcerated openings. The tube and ovary were, therefore, removed by ligature, the abdomen well washed out with warm water, and a drainage tube inserted. The patient was convalescent November 28th, temperature and pulse being normal.

FIBROUS POLYPI COMPLICATING THE PUERPERIUM.

In this communication HALLIDAY CROOM mentions briefly the previously recorded cases similar to his, and then narrates two observed by him.

Case I. Patient was first seen with retroverted and enlarged uterus; polypus was suspected. After dilatation with tupelo tents, the base of this polypus was felt, but Croom was unable to remove it. When next seen the patient was six months pregnant, and after spontaneous premature labor there was so much hemorrhage that the inside of the uterus was explored, and a polypus about the size of an orange twisted off from the fundus.

Despite intrauterine injection of corrosive sublimate, the patient died from septicæmia on the sixth day.

Case II. was somewhat similar, except that the labor was normal, and the patient recovered. The recorded cases are 21, grouped as follows:

1. Non-gangrenous, in which a healthy tumor was expelled without any artificial aid	5
2. Gangrenous	6
3. Gangrenous or non-gangrenous removed artificially with hand or instrument	10
Total	21

Budin, in his *Obstétrique et Gynécologie* (1886), records a case where labor was so obstructed, but the tumor was not expelled.

DEATH FROM SUBLIMATE POISONING AFTER TWO VAGINAL INJECTIONS.

Since 1885 corrosive sublimate has been used in the Prag. Obstetric Klinik, under Prof. Breisky's care, but in renal cases, in those with intestinal troubles,

and in anæmic and badly nourished women uterine injections of it were not employed. For bathing the external genitals and as a vaginal douche, 1:2000 was the strength of the douche, and if repeatedly used it was diluted to 1:4000. Up to August 28th of this year, according to FLEISCHMANN "Tödliche Sublimatvergiftung nach einer zweimaligen Scheidenausspülung." *Centralbl. für Gynäk.*, No. 47, 1886), 1620 cases were so treated with no bad result until the following:

M. C., seventeen, primipara, had been well during pregnancy with no symptoms of kidney affection. On the first day of her labor, August 28th, the vagina was douched with 1:2000 corrosive sublimate before and after a vaginal examination. Prior to this examination a small quantity of bloody slime had passed from the genitals. After the second douche pain was felt in the lower part of the abdomen with vomiting and diarrhœa. Carbolic douche was now employed and some laudanum given for the diarrhœa. The child was born on the 29th, the vagina being douched with carbolic lotion after the expulsion of the placenta, and catgut sutures applied to the perineal and vestibular tears.

The puerperium was briefly as follows:

August 29th (afternoon). Six fluid motions, salivation, scanty urine.

30th. Gums spongy; grayish-white spots below the tongue; throat congested; urine scanty and albuminous, with hyaline and granular casts, kidney and bladder epithelium, and broken-down red blood-corpuscles.

The diarrhœa and scanty urine continued; tympanites began on the 31st and death from coma occurred on September 5th, eight days after the use of the sublimate.

Post-mortem examination showed acute Bright's disease, dysentery, ulcerated stomatitis and pharyngitis, parenchymatous degeneration of the myocardium and liver, pneumonia, acute cystitis, and imperfect involution of the uterus.

Fleischmann discusses this case and comes to the conclusion that corrosive sublimate poisoning had occurred, the sublimate passing into the circulation through small lesions of the mucous membrane at the internal os. He believes with Thorn (*Volkmann's Samml.*, No. 250) that corrosive sublimate should never be used for vaginal or uterine douching, but only for the skin surfaces of the patient and medical man. Carbolic acid should be employed as a substitute in the former instances.

[This case is certainly exceptional. Mischief might have arisen from carbolic acid. It is probable that the sublimate passed by some mischance directly into the circulation. The fatal injections were given by a midwife, and it is not stated if any forcible dilatation was used.]

THE ORIGIN, DIAGNOSIS, AND SURGICAL TREATMENT OF GENITAL TUBERCULOSIS IN WOMEN.

For some time HEGAR (*Die Entstehung, Diagnose, und chirurgische Behandlung der Genitaltuberculose des Weibes*) had in his castration cases met with instances where the Fallopian tubes contained cheesy matter. Mandach, a Swiss practitioner, had, in 1882 and 1883, removed a tubercular kidney and afterward a tubercular Fallopian tube from a patient successfully, while Czerny had also removed a tubercular tube in a case of tubercular peritonitis.

Hegar had considered his cases as adhesive peritonitis with thickened pus in the tubes, and as a condition following pyosalpinx. The first thing that cast doubt on this idea was the occurrence of pulmonary disease afterward in such a patient: and he, therefore, reconsidered all such from a new etiological standpoint.

In the monograph, Hegar considers the subject of genital tuberculosis with special reference to diagnosis, origin, and treatment by laparotomy when pelvic in women.

The subject is so interesting and valuable that we abstract it fully.

Origin. Tuberculosis does not affect the testicle and ovary so frequently as it does the Fallopian tubes or epididymis. The body of the uterus, the vas deferens, and especially the cervix uteri, are rarely attacked: the vagina is less frequently involved than the uterus and tubes. Friedländer observed an isolated tubercular eruption below a shallow ulcer near the os uteri: nowhere else was there a similar affection. As to the frequency of primary genital tuberculosis, Dr. Mosler found eight out of forty-six instances primary; Frerichs, in ninety-six post-mortem examinations of tubercular bodies, found the sexual organs involved fifteen times, in three of these the affection being primary.

In men, genital tuberculosis, secondary or primary, is more common than in women, so far as one can trust statistics.

Hegar then discusses the question of the latency of genital and peritoneal tuberculosis, pointing out that it may run a slow, chronic course, and may spontaneously cure by caseation or suppuration. Cases of cure of peritoneal tuberculosis are not rare, and have been recorded by Wells, Neumann, and others. In men there is greater opportunity for cure than in women; but, although the Fallopian tube may be perforated, or the disease may spread through the ostium abdominale, it may become encapsuled by adhesion to neighboring organs, more especially to the posterior surface of the uterus or broad ligament.

The tubercular poison may reach the sexual organs either from without or through the body from other previously affected organs. Thus the phthisical sputum, or stool, may pass into the vagina from without, and set up mischief, as in cases where, on post-mortem, one finds lung excavation, ulceration of the bowel and vagina, without disturbance of the rest of the sexual tract.

The extension through the body is well known, and happens as follows: Tubercular affection of the intestine is present, and spreads through the wall of the bowel to the peritoneum, and thus affects the tube. It may pass along its lumen and into the uterus, owing to the ciliated epithelium. The bacilli have been detected in the folds of the fimbriated end by Schramm, the rest of the tube remaining sound.

The tubercular affection may further spread by perforation of a tubercular ulcer of the intestine. In one case the ulcer was rectal, opened into the vagina, and in this way the vagina, uterus, and peritoneum were affected, but not the tube. Most authors consider the blood stream as the usual carrier. In one case, of a five month's pregnancy, where the mother died without abortion, from miliary tuberculosis, no tubercle or bacilli were found at the placental site nor in the fetus.

In infection from without, the contagion may be conveyed by the finger, by irrigation tubes, etc. Coitus and puerperal conditions also afford opportunities.

Genital tuberculosis is more frequent in adults than in childhood, or after the menopause. Fernet gives four cases of women with primary sexual affection, after association with phthisical men; and, on the other hand, one case of caseous epididymitis in a man with no phthisical heredity, after suspicious intercourse. A case of cystitis (tubercular) after coitus, is also recorded where bacilli were found.

While no case of primary tuberculosis during pregnancy is known, it has often been noted after full time or premature births. This affection may be then acute, death occurring in nineteen to thirty-three days, but is also chronic.

We pass over the account of infection by vaccination, circumcision, instruments of gynecologists, as well as Hegar's comparison to gonorrhœal poison, merely remarking that the bacillary nature of tuberculosis explains such instances, that one can also understand mixed infection (gonorrhœa and tuberculosis) and that the tubercular poison may pass either along the mucous genital tract or by the lymph spaces of the connective tissue.

Diagnosis. The points to be considered in diagnosis are, heredity, the occurrence of infantile affections, and opportunities for infection.

The clinical picture will vary according to the site and extent of the process. We may have colpitis, endometritis, and especially chronic pelvic peritonitis; and, when chronic, we may have secondary nervous symptoms, with painful menstruation, sometimes profuse, sometimes scanty. Increase in temperature may be slight.

Early appearance of marked peritoneal exudation is noteworthy, and lung or bowel tuberculosis occurring with pelvic exudations will awaken the suspicion that the pelvic condition is also tubercular. The *physical* conditions are the most important. In vaginal tuberculosis we have miliary nodules, caseous masses, and ulcers. Detection of the bacilli is necessary to diagnosis. The tuberculous uterus is large, partly from tubercular infiltration, and partly from hyperplasia of its normal elements. Nodular enlargement may be found in the tubes, but the uterine enlargement is usually uniform. The affections of the tubes may be such that they are sausage-like or beaded, the enlargements varying in size from a bean to a walnut. These may blend and give a rounded tumor. The position of the tubes is altered—*i. e.*, they may lie at the side of the uterus, on the posterior or lateral pelvic walls, or in Douglas's pouch. They are seldom in the vesico-uterine pouch. Adhesions may occur altering the above conditions, and binding the tubes to the posterior aspect of the broad ligament.

The appearances given are like tubal dropsies, but on section of the tube in pyosalpinx we do not get circumscribed swellings. In tubercular tubes Hegar could squeeze out caseous, wormy masses, evidently from the tube lymphatics.

The tubercular nodules are, in addition, angular and polygonal, and may vary in consistence. The rest of the pelvic peritoneum (broad ligaments, utero-sacral ligaments) may be thickened and infiltrated, and, of course, we may also have general miliary peritonitis. A second form of tube affection is found where ovaries, tubes, and broad ligaments, and even uterus are matted in one large mass. This condition is difficult to separate from malignant or inflammatory conditions of the pelvic organs, and diagnosis in such instances is not easy.

Treatment. The importance of prophylaxis is evident. The marriage of the phthisical must be forbidden or limited. Phthisical and general patients should not be classed together, and in regard to instruments we must look on tubercular infection as we do on that of wounds. Phthisical sputum and stools must be disinfected, and phthisical nurses should not be allowed to attend puerperæ.

The initial stages of colpitis and endometritis have not been observed as yet, but if detected might be cured by curetting and the use of iodoform.

Extirpation of the uterus *per vaginam*, supravaginal excision of the cervix, removal of the tubes and ovaries, or, finally, mere abdominal section with drainage, are all operative possibilities. We must remember that tuberculosis is slower than carcinoma uteri, and that operative interference, even if incomplete, may bring about a cure. Removal of the tubes, ovaries, or uterus is indicated when their tubercular affection is primary, and not tending to quiescence. When secondarily affected, they may still be operatively treated if the changes in the other organs are not causing injury, or are yielding to treatment. Fresh tubercular peritonitis is no hindrance to operation.

The contra-indications to operative treatment are advancing disease in other organs, in which the genital disease plays only a secondary part; a greatly run-down condition, and great fixation of the affected organs, which not rarely indicates breaking down. One can, however, in such cases, open the abscesses and cavities.

Vaginal extirpation of the uterus can only be exceptionally practised, but when tubercular affection of the mucosa has not passed too deeply into the wall, we can employ curetting, cauterization, and application of iodoform. When the tubes are also affected, their vaginal extirpation is difficult, owing to uncertainty in the arrest of hemorrhage. Supravaginal amputation of the cervix needs no special remark, and we, therefore, pass on to the question of salpingotomy with castration.

Salpingotomy and castration can be practised when the tubes, ovaries, and neighboring portions of the broad ligaments are involved; when the uterus is simultaneously involved, but gives hopes of yielding to a later intrauterine treatment, or when peritonitis indicating abdominal section is present.

Hegar specially alludes here to the difficulties encountered when dense adhesions are present, and warns against mistaking the surface of the broad ligament affected, penetrating it, and causing bleeding in attempts to enucleate.

The posterior lamina of the broad ligament is the one on which the tubercular tubes and ovaries usually lie.

In one case he treated a fixed uterine adhesion (three centimetres in diameter) by the extraperitoneal method: and, as the other tube had been deep and fixed, and breaking down caseous matter present, with parenchymatous bleeding going on, he penetrated the vaginal roof, and plugged with a long strip of iodoform gauze, bringing the end into the vagina. The result was good.

In one case a small tubercular nodule was on the uterine horn and required intraperitoneal ligature. If the uterine cavity is opened, however, one must treat it extraperitoneal. When the broad ligaments are unyielding, the elastic ligature may be necessary.

The opening and evacuation of tubal tumors through the vagina or abdominal walls, with subsequent drainage, injections, etc., may be employed, when the

patient's strength and the condition of the other organs permit. The relations here are much as in pyosalpinx. The tube walls are often intact and the cavities closed by adhesions of the fimbriated end. The ostium abdominale may, however, be patent, and the wall of the tube perforated. Thus the contents may escape and set up a septic peritonitis. The tube may, in great part, be destroyed and then the cavity made up of false membranes and the pelvic walls or organs. The tumor may be in the true pelvis or projecting up to the abdominal wall, or separated by omentum and intestine. Seldom is it adherent to the parietal peritoneum.

The operations on such tubercular cavities have been performed by Aran, who punctured per rectum. Hegar has performed salpingectomy and castration in six cases. Mandach has performed it once with a good result.

Hegar's results have been as follows: One patient died; a second was well six months after the operation. A third was well six months after, and was free from pain; had not menstruated. Then the period returned as well as the pain, and suspicious lung symptoms came on. The ultimate result three years after the operation has been good. A fourth case had double pleurisy, apex pneumonia, and other troubles four months after operation, but is now, a year after, in good condition. The fifth and sixth cases gave good results.

The following are some of the cases:

Case I. History of suspicious (tubercular) illnesses in childhood; defective development of the uterus (infantile). Amenorrhœa with menstrual moli-mina; remains of old pelvic peritonitis; tubes with caseous contents. Castration and salpingectomy. Cure. Tubes and ovaries were found adherent and the former were follicular. The tubes were dilated and caseous, the fimbriated end closed. The diagnosis was based on the pelvic condition, the history, and the lung condition.

Case IV. Phthisis in the family; dysmenorrhœa; attacks of pain, especially during the menses. Primary tuberculosis of the tubes; castration and salpingectomy; discovery of the bacilli.

Case V. Beginning of the disease in childbed with endometritis; swelling of lymphatic glands; menorrhagia. Castration and salpingotomy; recovery. Six months after, pleurisy and lymphatic swellings. Condition good one year after.

TUBAL DISEASE.

A. MARTIN, of Berlin, points out (*Zeitschrift für Geburtshülfe und Gynäk.*, Bd. xiii. Hft. 2) that the chapter on tubal disease is usually one of the shortest in text-books, and one leaving little impression on the reader. These diseases have, however, received attention from several during the last ten years. Hegar, in his classical work on castration, as well as through his pupils, has given his operative experiences. Lawson Tait has vindicated a special rôle in the sexual life for the tubes; while Martin and his assistant, Bertram, have published diagnostic and pathological points. Veit has written specially on tubal pregnancy; and Hegar has recently published a special monograph on tuberculosis in the tubes. The special works of Hennig and Bandl must also be taken into account.

Winckel, in 500 cadavera, found the tubes affected in 300. Martin, in 1000

unpicked patients in his Policlinik, found 63 suffering from it, apart from many cases where it was secondary.

Passing over statistics as to age, existence of other pelvic conditions, we note that in 147 cases, chronic or acute, endometric disease was the source of the tubal mischief. 70 times it was in relation to the puerperium, especially that of premature labor.

55 patients were gonorrhœal, 3 had still fresh traces of syphilis, and 10 were tubercular. In 122 cases there were changes in the pelvic peritoneum, ovaries, and broad ligaments, and in 11 the passage of the mischief from tube to peritoneum was traced; in no case was it noted as advancing from peritoneum to tube. In 2 (of the 11) the tube burst; in the others the mischief happened from the passage of fluids into the peritoneum through the ostium abdominale of the tube.

In 91 cases both tubes were affected, in 58 the right only, and in 138 the left only. In regard to the structure of the tube, Martin briefly mentions its mucous membrane, arranged in folds running in the long axis of the tube, and the absence of glands and papillæ. The folding of the mucous membrane is most marked at the abdominal end of the tube. The musculature is most marked at the uterine ends.

The inflammatory processes may be I. *Endo-salpingitis*, or *catarrhal salpingitis*, II. *Interstitial salpingitis*, and III. *Follicular salpingitis*.

In *endosalpingitis* there is swelling of the folds of the mucous membrane, abundant small-celled infiltration of the mucous membrane, the epithelium remaining intact. The vessels are distended, and ecchymoses are seen here and there.

In *interstitial salpingitis* we have an analogous change in the muscular wall: the tube is of a size varying from that of a lead pencil to that of the little finger. The mucous membrane points at the ostium abdominale.

In *follicular salpingitis* the wall is thickened and enlarged by the presence of what are like cysts on section; the wall seems alveolar and small-celled infiltration with loss of the mucous membrane epithelium is present. Further developments depend on the changes in the muscular walls, in the lumen of the tube, or on the advent of microorganisms. We may thus get distention, muscular hypertrophy, atresia, occlusions of the abdominal end, hydrops tubæ, and so on.

The microorganisms which may infect are those of puerperal sepsis, gonococci, tubercle bacilli, and, in one case, of actinomycosis. The first, Martin believes to be the most common.

In the symptomatology of tubal disease, Martin emphasizes the localization by the patients of the pain in the side of the pelvis, as well as the colicky pains which occasionally end with the escape of fluid from the uterus. Most of the patients complain of profuse pain and irregular menstruation, and have marked disturbance of the general health.

The diagnosis is also made out by palpation, in the way well known to those who practise bimanual examination.

In treatment, Martin points out the value of medicine, especially antiphlogistic remedies, as only one-fifth of his cases required extirpation. Bleeding, rest, energetic action on the bowels, and narcotics during the paroxysms of pain, as well as remedies causing absorption, should be employed. In gonor-

rhoeal cases Martin has used, with good results, unguentum hydrargyri cinerium.

In 72 cases he removed the tubes and ovaries; in 30, both tubes; in 42, one; and in 4 cases he removed first the one and then the other. In most of the cases, adhesions to the ovary and surrounding parts were present, and in some adhesions to the bowel, or even perforation was present. These Martin regards as bad cases, and 3 of his 12 deaths were ascribed to this. In 1, tubercular lung mischief was present, but without tuberculosis in the pyosalpinx. 1 died from cancerous cachexia from primary tubal cancer, 5 died from sepsis, and in 2 the cause of death was unknown.

Martin does not wash out the peritoneum unless he cannot help it, and taps the distended tubes before separating them.

He usually closes the wound fully, or drains either through the vagina or in such a way as to close off the portion requiring drainage from the rest of the peritoneal cavity.

THE DIAGNOSIS OF COMMENCING CANCER OF THE PORTIO.

STRATZ (*Zeitschrift für Geb. und Gynäk.*, Bd. xiii. Heft 1) points out that the operative methods of the treatment of malignant disease of the uterus have so far been tested by time, and we can now say with certainty that carcinoma is curable. Already have cases been recorded where women have enjoyed eight years of undisturbed health after operation.

There is further quite a series of cases of special interest where, on *post-mortem* examination some years after operation, no traces of uterine cancer were found, while often in the ovary, pelvic connective tissue, etc., carcinomatous disease had established itself. One special case where Schröder had performed supravaginal amputation, had, on subsequent section, the scar and uterine remains free, but the whole pelvis filled with malignant masses.

Stratz believes, therefore, that cancer is curable, and that the earlier the operation the better the result. He deprecates palliative treatment as only rendering radical treatment impossible, and condemns those who hold cancer incurable. It is of the utmost importance, therefore, to diagnosticate carcinoma early, and subject it to prompt radical treatment.

He points out, however, that the early symptoms of cancer are so slight that women consult a specialist too late. The family physician has the opportunity of being consulted early, and has the opportunity, therefore, of seeing the initial symptoms, such as increase in the menstrual flow, slight pains, and so on. A specially frequent and well-known symptom is bleeding after coitus. When for such symptoms one can exclude external influences, the question of cancer as their source must be considered.

The early physical signs of carcinoma are not well marked, and it may be impossible to diagnosticate early malignant disease without microscopic examination of the suspicious tissue. Ruge and Veit have shown that one can only suspect beginning cancer from symptoms: this suspicion can be established by microscopic investigation.

Stratz records some cases of early carcinoma, points out the difficulty of diagnosis by the naked eye, and concludes that the important signs of early malignant disease of the cervix are: 1. The affected portion separates sharply

from the sound tissue. 2. One can see a difference in the plane of the affected as compared with the sound tissue. 3. The cancerous portions have a yellowish tinge. 4. The malignant parts are usually small, nodular, whitish-yellow prominences.

ON ONE-SIDED HYPERTROPHY OF THE VAGINAL PORTION OF THE CERVIX.

The hypertrophies of the supravaginal and middle portions of the cervix are believed to be brought about by traction exerted on these by prolapse in the vaginal wall. On the other hand, the hypertrophy of the vaginal portion is not evident, and has been attributed to the irritation of pessaries, to masturbation, or circulatory disturbances.

One certain fact is that we get hypertrophy of the vaginal portion as the only form in nulliparæ, while in parous women, and in the chronic metritis of nulliparæ, the portio vaginalis is small; in the parous it is large. The hypertrophic processes are either simple or follicular; in the former all the elements of the cervix are involved, in the latter, chiefly the mucous membrane. Partial hypertrophies are associated with cervical laceration. Of such hypertrophies, that of the anterior lip is the most common, the posterior lip following next, and the lateral hypertrophies last. Simple partial hypertrophies are, therefore, associated with lacerations brought about by labor. Follicular hypertrophy may exist in nulliparæ, and is related, doubtless, to ectropion, is always partial, and is not so evidently associated with a preceding labor. Symmetrical follicular hypertrophy has not yet been observed.

STRATZ (*Ueber einseitige Hypertrophie des untern Cervicalabschnitts*) takes up more especially one-sided hypertrophies. The only cases of any size are recorded by Cazeau, Tarnier, and Huguier. Three cases are given by Stratz.

MENSTRUATION IN MONKEYS.

MR. BLAND SUTTON (*Brit. Gynec. Journal*, November, 1886) first considers menstruation in the human female. From an examination of the uteri of young females during gestation he has come to the conclusion that during menstruation only the epithelium of the uterus passes away; this is accompanied with blood and mucus. He criticises Dr. Williams's view on the question; but it is important to note, however, that Mr. Sutton does not define the mucous membrane of the uterus as Dr. Williams does, and that he makes no reference to the elaborate papers of Kundrat and Engelmann and Leopold. Dr. Williams includes the muscular fibre of the uterus in the term mucous membrane, and believes that the mucous membrane down to it—*i. e.*, the glandular mucous membrane—is removed. This is a superficial removal only when we consider his definition. The view advanced by Sutton differs little from that given by Leopold.

In Macaque monkeys and baboons during menstruation Sutton has been able to show that the epithelial lining of the uterus is not shed, and that the amount of blood escaping is small.

MEDICAL JURISPRUDENCE AND TOXICOLOGY.

 UNDER THE CHARGE OF

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PROPHYLAXIS OF HYDROPHOBIA.

PASTEUR has recently (November, 1886) communicated to the *Académie des Sciences* the results of the employment of his much heard of method during the one year which has elapsed since he gave his first communication to the Académie on October 26, 1885. 2490 persons, supposed to have been bitten by mad dogs, were treated by his method during that period. The treatment of each was uniform, lasting always for ten days, during which a daily injection of infusion of spinal cord of a rabbit was made, beginning with a cord of fourteen days' exposure, and ending with one of five days. He classifies the patients according to their nationality. It is interesting to note that while, as was to be expected, the majority (about two-thirds) were French, 80 were English, 21 American, and many came from the remotest parts of Europe. Out of the 1726 French and Algerian cases, 10 were unsuccessful, the patients afterward dying of hydrophobia. This is equal to a mortality of 1 in 172. During the five years preceding November, 1885, the number of deaths from hydrophobia in the hospitals of Paris was, on an average, 12 a year. During the year ending November, 1886, there have been only 3 deaths, and in 2 of these the patient had not previously been treated by Pasteur's method. Pasteur believes that these results are strongly confirmatory of the utility of his method.

He has found it necessary to modify his method in the case of patients bitten on the face or head, or bitten very severely elsewhere, especially if the parts were naked. This he does by passing more rapidly than usual, and with omissions, through the injection of the graded cords, until a spinal cord of one day old is used.

Finally, in order to meet the objection which has been raised to the experiments on dogs, on which his method is based, that the dogs were inoculated *before* being bitten, whereas men are inoculated *after* they are bitten, Pasteur has made some fresh experiments on dogs in which he practised intracranial injection with fresh unmitigated virus, and then inoculated the animals some time afterward in the usual way. These experiments were evidently not very successful, hydrophobia appearing in most of them. Pasteur concludes with the remark that the immunity conferred by inoculation previous to infection offers the best proof of the excellence of the method.

 PHARMACOLOGICAL AND TOXICOLOGICAL STUDY OF DIGITALIN.

LAFON (*Annal. d'hygiène Publique*, sér. 3, tom. xvi. pp. 429-444, and 506-519) begins with a comparison of the physical and chemical characters of the different commercial varieties of digitalin. These are chiefly the crystallized digitalin of Nativelle, the amorphous digitalin of Homolle and Duquesnel,

and the crystallized and amorphous digitalins of Germany (Merck). The German varieties are fairly soluble in water, while the others are very slightly soluble. In chloroform the latter are more soluble than the former, which are insoluble. Further, the latter do not yield the author's reaction (*vide* this journal, 1886, p. 345) with sulphuric acid and perchloride of iron, while the former do. Further comparison leads to the conclusion that all the French varieties of crystallized digitalin are identical in their physical and chemical properties; that the amorphous digitalin of Homolle and Quèvenne is nearly identical with the digitoxin of the Germans, and resembles the French digitalins in its chemical properties, though considerably differing from them in its fusion point; and that the German digitalin differs from the French digitalin in many of its chemical properties.

In the next place, the author proceeds to prescribe a method of separating the digitalin in a case of poisoning by it. He says Stas's, Otto's, and Dragendorff's methods readily allow of the separation of the digitalin, but not in a very pure form. And as the purity of the separated digitalin is of great importance in the application of the author's color reaction, he describes a modified process by which the digitalin can be obtained in a purer form than is usual. The material supposed to contain the digitalin is to be thoroughly extracted with hot alcohol, then filtered; and the filtrate evaporated until nearly all the alcohol is driven off. An abundant precipitate forms in the aqueous residue, which is separated by filtration through glass wool. Subacetate of lead is now added to the filtrate, which is again filtered. The filtrate is next treated with sulphuric acid to remove the excess of lead, and is once more filtered. The filtrate is now shaken with chloroform, which removes the digitalin in a very pure form, and which, after the evaporation of the chloroform, can be employed for the author's reaction. By such a proceeding the author has been able to detect 1 mgrm. (0.015 grain) in 200 c. cm. of urine, and 3 to 4 mgrms. in vomits, soups, blood, etc.

The next portion of the author's communication is devoted to experiments on the action of digitalin on dogs, given *per os*, subcutaneously, and intravenously. Homolle and Quèvenne's digitalin appears to have been used in all these experiments (which are twenty-five in number) except in one or two, in which digitalis powder was employed. The experiments were mainly directed toward ascertaining to what extent the digitalin could be afterward detected in the body. His conclusions in this respect are (1) where small poisonous doses have been given *per os*, no trace of digitalin is discoverable in the urine, blood, liver, kidneys, lungs, brain, etc. But if the dose is over 10 centigrammes ($1\frac{1}{2}$ grains), and vomiting has not occurred, the poison can be detected within the body: (2) the digitalin is most easily found in the contents of the stomach or intestines (or in the vomit); (3) after poisoning *per os* by small doses, digitalin cannot be detected in the internal organs of an animal which has been buried for some time (six to seven months) (4) after poisoning by subcutaneous injection, the digitalin is not to be found anywhere unless in the muscles in the vicinity of the seat of injection; (5) after poisoning by intravenous injection, the digitalin cannot be detected unless the animal dies, or is killed, within ten to twenty minutes after the injection.

With regard to the relative toxicity of the various kinds of digitalin when administered subcutaneously, the author finds that (1) the various crystalline

digitalins (Nativelle's, Duquesnel's, Homolle and Quèvenne's, Mialhe's) have nearly the same activity—about two milligrammes per kilogramme of body weight being sufficient to kill a dog; (2) the so-called “digitalin chloroformique” (Codex) of Homolle and Quèvenne possesses the same toxicity as the foregoing; (3) that the German digitoxin, although considered more active than these others, is not so, and possesses about the same activity.

As to the elimination of digitalin from the organism, the results of the author's experiments appear to point to its more or less complete destruction within the body. It is only found in the urine when very large doses have been administered, even though injected intravenously. In the case of two patients who were receiving 40 centigrammes (6 grains) daily of digitalis leaves in the form of an infusion, no digitalin could be detected in the urine. But if 40 centigrammes of digitalis were digested with urine, the digitalin could afterward be readily separated and recognized.

With reference to the supposed accumulation of digitalin within the body after repeated doses of it, the author was not able to find any confirmation of this supposition.

The author finally investigated the resistance of digitalin to the action of diastase, pepsine, pancreatic juice, bile, mineral acids, caustic alkalies, yeast ferment, and emulsine, as also to the action of putrefaction, and found that the digitalin was little affected. He therefore infers that it is not decomposed in the alimentary canal, but is probably much transformed in the blood.

ACCIDENTAL POISONING FROM THE USE OF SUBNITRATE OF BISMUTH IN SURGICAL DRESSINGS.

DALCHÉ, of the Hotel Dieu, reports two such cases in the *Annales d'hygiène Publique* (sér. 3, tom. xvi. pp. 358–361). The first is that of a woman who was admitted to the hospital with a very extensive burn over the back and left arm. It was dressed with subnitrate of bismuth, the dressing being renewed every two days. About a fortnight after the commencement of the treatment the patient began to complain of slight pain in the throat, accompanied by dysphagia. On the under surface of the soft palate a white false membrane was observed, which extended to the tonsils. In two days the membrane became more extended, and was covered with a blackish mucus. A small patch of membrane was also noticed on the lower lip. The breath became fetid, and the false membranes gradually became detached and loose, but with the formation of new membranes in other parts of the throat and mouth. A few days later diarrhœa, and afterward vomiting, set in. The bismuth dressing was now stopped. The preparation used was found to be absolutely pure, and the presence of bismuth was detected in the feces and the urine. Albumen was also found in the urine. The vomiting and diarrhœa continued for two or three days after the stoppage of the bismuth. But the other symptoms of bismuth poisoning did not entirely disappear until after a month.

The other case was that of a young, thin, anæmic girl, whose knee had been excised and the wound dressed with the subnitrate. A fortnight after the operation, without elevation of temperature, the patient lost her appetite, was salivated, and presented all the symptoms of stomatitis. Bismuth was found in the urine. The course of this case was similar to that of the first.

The author quotes Rabuteau as saying that Dubinsky found "that bismuth, which is largely eliminated in the saliva, produces in the buccal mucous membranes effects which are similar to those of mercury." The author appears to be unaware of Steinfeld's recent investigation of the action of the salts of bismuth.

THE NEW MORTUARY IN BERLIN.

PROF. LIMAN (*Viertelj. f. gerichtl. Med.*, N. F., Bd. xlv. S. 170-178) gives a description, with plans, of the new mortuary which has just been completed in Berlin. It is a large horseshoe-shaped building, fifty-six metres long, and nineteen metres broad. It has been constructed with three objects in view: (1) To supply an ordinary police mortuary, for the laying out and identification of such dead bodies as come into the possession of the police; (2) to provide accommodation for the complete medical examination of the bodies in needful cases; and (3) for the teaching of medical jurisprudence. The central part of the building is devoted almost entirely to meeting the first of these objects. Besides cellars for holding identified bodies, there are seven small chambers for the exhibition of unidentified bodies, two in each. These chambers are lighted from above, and lie along a public corridor, from which they are separated, as well as from each other, by a glass partition. The temperature in these chambers and in the cellars is kept at 0° to 2° C. by means of copper pipes in which a solution of calcic chloride circulates, the solution being cooled by an ammonia ice machine in an adjacent cellar. On the same level as these chambers are two large rooms, one for washing the bodies and another for depositing the bodies after they are coffined. Conveniently near is a small chapel, where funeral obsequies may be performed in connection with bodies about to be removed for burial. A hydraulic elevator, capable of lifting three hundred kilos., is used for lifting bodies from one story of the building to another. The right wing of the building consists of two stories, one of which is devoted to the medico-legal examination of bodies, and the other to arrangements for teaching. In the former there is a commodious autopsy room, with two tables, two chemical laboratories, two private rooms for the physicians, a room for the crown officer, and a small waiting-room for the witnesses required to identify the bodies; in the latter, which is placed above the other, there is another autopsy room for purely teaching purposes, a lecture-room, a museum, a small library, and private rooms for the director of the institute and his assistant. The left wing of the building is mainly devoted to providing accommodation for servants. It also contains a telegraph office. The building, altogether, appears to be well planned, and might form a model for similar institutions in other towns.

HANGING IN HOT COUNTRIES.

PELLEREAU, of Mauritius, gives an interesting account of hanging in tropical climates (*Annal. d'hyg. Publ.*, sér. 3, tom. xvi. pp. 108-125, 1886). Accidental or homicidal hanging is rare, just as in colder countries. Hanging is nearly always suicidal, and is the mode of death most frequently resorted to by suicides. In Port Louis (population, 60,000) fifty cases of suicidal hanging occurred in six years (1878-1883). This mode of suicide is in favor, especially among the

inferior classes of the population, the Creoles and Indians. The better classes, and the Chinese in Mauritius, have recourse more frequently to fire-arms or poison. Hanging is more common among the men than the women. The author has frequently been present at cases of judicial hanging, and has carefully observed the appearances at death and at the autopsy. The phenomena he divides into three successive groups or stages: first, a short period of immobility; second, a period of tetanic rigidity; and third, a period of clonic convulsions. Altogether they do not extend over more than two or three to five minutes. The onset of cadaveric rigidity is somewhat retarded. The post-mortem appearances are, in general, similar to those seen in other countries. In answering the question whether the hanging, in a doubtful case, has taken place during life, the author lays stress on swelling and lividity of the face; tongue between the teeth, enlarged and excoriated; excoriations on the superior and inferior extremities; evacuation of semen; staining of the scrotum and buttocks with urine and feces; mark of the cord; congestion of the brain and its envelopes; congestion of the larynx, trachea, bronchi, and lungs; congestion of the jejunum, ileum, and kidneys; dislocation of the atlas. These appearances may be all present in one case. Sometimes they are nearly all absent. In such a case the trickling out of the saliva from the mouth, and the presence of fragments of food in the larynx, trachea, bronchi, and œsophagus, as also the existence of petechiæ on the inferior extremities, and collapse of the lungs, may be looked for.

PUBLIC HEALTH.

UNDER THE CHARGE OF

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RECENT PREVALENCE OF CHOLERA IN EUROPE.

DR. BUCHANAN, F.R.S. the Medical Officer of the Local Government Board of England, has presented to his Board a report, giving (1) account of the prevalence of cholera in Europe in 1884 and 1885; (2) account of the International Conference which was held at Rome; (3) abstract reports on the condition of English ports and other districts in relation to their security against cholera; (4) some recent researches into the pathology of cholera. The first subject only can be referred to in this number.

An important part of the report on cholera prevalence is a statement by Dr. Thorne of the behavior of this disease in different European countries. Much care has been taken to make this as complete as possible, but at the time of its preparation the French Government had not issued their official report, except so far as relates to Paris.

(1884) In France the disease first appeared at Toulon, when, on June 23, 1884, it was announced that fourteen deaths had taken place. The disease was

soon recognized to be epidemic cholera, but some doubt still remains as to the means by which it was introduced. In the first instance it was supposed to have been conveyed by the "Sarthe," a French transport which had recently returned from Cochin China, two cases of the disease having occurred on April 1 and 2, 1884, while the vessel was at Saigon; but it was ascertained that the patients were set ashore, the vessel disinfected, and no other cases occurred during the subsequent forty-five days that the vessel took to reach Toulon. Search was therefore made for other means of introduction of the disease, when it was found that other transports returning from China had also had cases of cholera on board. A considerable exodus from Toulon took place, the disease rapidly extended to Marseilles, and speedily increased in these two cities, the public press returning somewhat over 880 fatal attacks in Toulon, and not very far from 2000 in Marseilles. Monsieur Guérard, an engineer, says that the most neglected portions of the town of Marseilles in point of cleanliness were those which were most fatally affected.

As cholera diminished in the south of France, it manifested itself in the north, beginning at Yport, a small fishing village on the coast of Normandy, where the disease was imported by the arrival, on September 28, of two of the crew of the "Louise Marie" from the port of Cette. An interesting account by Dr. Guibert, of Havre, supplies material which enables the diffusion of the disease in this town to be understood.

By November 1 the town of Nantes had been invaded, and a few days later deaths from cholera occurred in Paris, altogether 938 persons dying in the latter city. The total number of deaths known to have occurred during 1884 in France amounts to some 5000.

In Italy considerable precautions were taken by the government to prevent the introduction of disease into that country; they were of the usual quarantine kind, and are described by Dr. Thorne at some length. Among these precautions was the removal from Toulon of Italian operatives in a vessel especially sent for the purpose, these people being detained in quarantine before being allowed to land at any Italian port. Nevertheless, one Italian workman returning from that city, and after having undergone the required quarantine, developed cholera at Spezia, and other deaths occurred among the soldiers forming the sanitary cordon round the village of Pancalieri at the foot of Monte Viso, where some Italian workmen from Toulon had been taken ill. In the meantime cholera had appeared in Cuneo on June 28th, Livorno on July 14th, Porto Maurizio on July 17th, Genoa on July 19th, and Turin on July 20th. The disease rapidly spread, and reached Naples by August 27th.

With a view to confining the disease in Spezia, there were provided a military cordon on shore, and a maritime cordon in the bay, supported by gunboats, but it was largely evaded, and it is stated that within two days of the official announcement of the epidemic in Spezia, no less than six thousand of the inhabitants fled from the place. In September there was a great increase in the severity of the epidemic and in its diffusion, numerous deaths occurring in the province and city of Genoa, in the provinces of Parma, Bergamo, Cuneo, Massa, Carrara, and Caserta.

In the city of Genoa cholera was attributed, according to local correspondents, to the use of polluted water supplied by the aqueduct of the Nicolai

Society, the source of which is near Busalla, where cholera had been very prevalent, and in this water it is stated the clothes of cholera patients had been washed. The municipality ordered the Nicolai Society to discontinue the supply of this water.

Rome remained free, but the disease extended to the Adriatic provinces of Rovigo and Ferrara, and outbreaks occurred in some of the more scattered portions of the peninsula, a single death also occurring in Palermo.

In Naples the disease manifested itself with the greatest severity, by the end of September 5700 cholera deaths having taken place in the city, in addition to 520 deaths in other parts of the province. The disease is believed to have been introduced into Naples by Sicilian workmen from Marseilles who, after having been subjected to quarantine, arrived in Naples on August 3d, and took up their quarters in the Porto district, of which the sanitary circumstances were most defective. They were subsequently removed to a floating lazaretto, but it is believed the removal came too late, for two days afterward the first case of cholera occurred in the city. The four districts of the city most severely affected were those notoriously the most unhealthy and filthy.

The epidemic in Italy was maintained up to the middle of October, but terminated at the end of that month. The total fatality of the disease in that country, judged from the various sources to which Dr. Thorne had access, being 11,500 persons; but this number, Dr. Thorne remarks, falls short of the actual mortality from this disease, which, according to a report of the Ministry of the Interior at Rome, caused a total of 27,030 cases, and 14,299 deaths.

In Spain, where quarantine regulations were strictly enforced, cholera also made its appearance, invading first Novelda and Monforte, two inland towns in the Mediterranean province of Alicante, where deaths occurred late in August or early in September. Subsequently Elche, in the same province, was attacked, and on the 18th of September cholera appeared in the coast town of Alicante. There is reason, however, for believing this port to have been invaded at an earlier date, the disease being imported by a vessel from Algiers, which had amongst its passengers a family from Cette, who took up their abode in a house where cases of cholera subsequently appeared.

The disease thus spread in the provinces of Alicante, Tarragona, and Lerida, and at the end of November deaths were recorded in Toledo and in the coast province of Valencia, and finally, in December, four deaths occurred at Vergel, close to the northern boundary of the province of Alicante. In all, intelligence was received of 274 cholera deaths in Spain during 1884.

In England, in 1884, on three occasions ships arrived with cases of cholera on board, or with persons who were convalescent from attacks of cholera; the sufferers were in each instance removed to hospital, and there was no subsequent case of cholera on shore.

(1885) During the following year (1885), in the beginning of June, cholera was publicly announced to be prevailing in Spain, the cases being situated in Castellon, Valencia, and Mercia, and a few cases in Madrid, the three coast provinces neighboring to that of Alicante, which suffered from the disease in 1884. Before this announcement, however, it was known that a dangerous epidemic of some sort prevailed at Xativa, in the province of Valencia, and that there were other cases in the southwest portion of the same province.

Portugal and France, moreover, had declared Spain to be infected, and quarantine measures were imposed. During June the disease spread rapidly in each of the above provinces, attacking a number of cities, including the cities of Cienpozuelos, Cartagena, Saragossa, Aranjuez, Cuença, and Toledo, and the provinces of Huesca, Saragossa, Cuença, Alicante, Toledo, and Teruel.

During July the epidemic increased both in severity and in the area of its diffusion, and in August the infected area included further the provinces of Gerona, Navarre, Logrono, Burgos, and Palencia to the north, Almeria to the extreme south, Salamanca on the west, and Valladolid and Guadalajara toward the centre of the kingdom. The month of September exhibited a considerable decrease in the intensity of the epidemic, but Dr. Thorne observes that the extent and suddenness of the decrease cannot have been anything like as great as would appear from the published statistics.

Altogether 338,685 cases were reported, and 119,620 deaths. Of the large Spanish towns Aranjuez was by far the most severely stricken. Within only one month 19.8 per cent. of the nominal population suffered, and 10.1 per cent. died of cholera.

Gibraltar had altogether 34 cases, and 25 deaths; the disease, according to Surgeon-Major Staples, resembling in its incidence the epidemic of 1865, the poor quarters being mainly attacked, where impurity of air from overcrowding, faulty sanitary circumstances, the impurity of drinking water, and unwholesome food supplies were associated with its prevalence.

It is noteworthy that with a population of some 24,000 persons the cholera deaths in Gibraltar amounted to 23, whereas in the neighboring Spanish town of Linea, with only about half as large a population, no less than 194 fatal attacks occurred.

The necessity of bringing food supplies from Linea into Gibraltar, which is entered daily by some 4000 persons from Spain, rendered it impossible to prevent communication between these two places, and no measures of land quarantine or other restrictions on the movements of the population were attempted.

In 1886 the disease lingered during the first few months at Algeciras, in the province of Malaga and at Tarifa.

In France, in 1885, there was no record of cholera until August 2d, when 12 fatal attacks were reported in Marseilles. From this date the disease rapidly extended, lasting until the middle of September, and causing 1039 deaths. In Toulon a fatal case occurred on August 8th, and subsequent cases were reported even as late as October, making a total of 314 deaths.

During October, 1885, deaths from a disease resembling cholera were reported as having occurred in the department of Finisterre, in November three cholera deaths were reported from the Pyrénées Orientales, and early in the same month the disease also appeared in the neighborhood of Quemper, being apparently introduced into this district from Toulon by the arrival of seamen on furlough from war ships or transports from Tonquin.

In Italy, in 1885, a few cases of cholera occurred at Gaëta in January, and from that time till August 1st no cases are known to have occurred. In this month cases were reported in the following provinces: Naples, Massa, Genoa, Cremona, Porto Maurizio, Venice, Parma, Piacenza, Alessandria, Modena, and Caserta. On September 6th cholera appeared in Palermo, the capital of

Sicily, causing a serious mortality during that month, but diminishing during October. The epidemic occasioned 2287 deaths, while in the rest of the province of Palermo further deaths to the number of 672 occurred, a smaller number of deaths taking place in other parts of the island. During September other Italian provinces were invaded, in the majority the outbreaks being trivial; but in the provinces of Reggio Emilia, Rovigo, and Ferrara they were more serious. The official report issued by the Minister of the Interior gives account of 6397 attacks, and 3459 deaths among the inhabitants of Italy during 1885.

In the latter part of the year the disease subsided, and from the end of October until December 23 no further intelligence was forthcoming; but at that date a few cases occurred in the city of Venice, and others in the rest of the province.

(1886) For the first three months of 1886 there was no information of cholera in Italy, but in the beginning of April cases were reported on the coast at Brindisi and Manopoli, others during the month occurring in the surrounding country. Again, a few cases were reported on May 1 in Venice, and the mortality continued until the close of May, when there had been 276 cases and 151 deaths in this place.

England remained free from cholera during 1885 and 1886, but in a few instances vessels arriving from foreign infected ports, having had on board deaths from cholera or diarrhoea, were dealt with under the cholera order of 1883.

Dr. Buchanan notes that Dr. Thorne "gives some instructive and significant illustrations of the relation between filth and our present cholera epidemic; he further shows that each country which had been invaded received the disease by its littoral provinces, and he tells how countries which profess to take strict quarantine precautions have suffered; some very severely, and others (it would seem) not at all, the latter resembling in this respect our own country, which imposes no quarantine whatever against cholera upon any of the multitude of vessels which reach its shores from the infected countries."

Account will be given of the other subjects in the report in the next number of this journal.

RECENT INOCULATIONS OF SMALLPOX VIRUS.

The *Gazette Médicale de Nantes* relates the history of smallpox from which the inhabitants of Tanganika suffered so long. Whole villages were destroyed by this terrible disease, and though lymph had several times been brought from Europe, it had always failed to produce any result in those vaccinated. At last it was determined to try inoculation with smallpox matter. Five hundred persons were inoculated; of these none died, the majority had three pustules at the site of inoculation, some had two, or even one pustule, but all had fever, a few somewhat severely. The material for inoculation was taken from a smallpox patient, a child who had an attack of discrete variola, and the lymph from its pustules was inoculated into all who came. The same happened in other towns; in only one case did the person die after being inoculated, and he was, probably, incubating smallpox at the time of the operation. In one village, in forty-eight hours, over five hundred

were inoculated, and since that time only four persons in that village have died from variola, none of them being willing to submit to inoculation.—*Journal d'Hygiène*, vol. ii., No. 529.

INSPECTION OF MEAT IN PARIS.

In Paris the police are charged with the duty of regulating the sale of meat, and inspecting all meat sold within the city. The law which is concerned with the suppression of fraud with regard to provisions was passed in 1851, but the decree of the prefect of police of 1879 is that under which the police act for the seizing and condemning of meat. There are 57 inspectors, and before they can be admitted they must pass an examination on some veterinary subject, and also a practical examination at a slaughter-house in Paris. No butcher's meat or pork, fresh, salted, or smoked, may enter Paris without previously being inspected, save in very small quantities. The meat must only enter by certain gates, or during certain hours; all meat found to be unfit for consumption is seized at once and destroyed at the expense of the owner, except when he requires it to be returned to him for industrial purposes, it is then sprinkled with oil of turpentine, or some other chemical, to prevent its being used for food. It is sold to horse-killers when quite unfit for food, but when only contaminated it is handed to the guardians of the Jardin des Plantes for the use of the animals. Other provisions, also, undergo a rigorous inspection under the same law, but by a different class of inspectors, who report to the Municipal Laboratory of Chemistry. There are twenty inspectors, and two are attached to each of the ten sections of the city. They examine provisions in the markets and in the shops, and they are also provided with a microscope and reagents for testing. If the goods are really bad they are destroyed at once; if only adulterated they are analyzed, and the owners punished by fines, or even imprisonment. The inspectors report every day, and record all the work performed in each section of the city.—*British Medical Journal*, January 8, 1887.

THE ETIOLOGY OF "CHARBON," AND THE DRAINAGE OF MARSH LAND.

MESSIEURS BOULEY and RAYNAL, in their *Dictionary of Veterinary Medicine*, give their views with regard to charbon.

In countries where marshes occupy a large surface, charbon is most often observed, also in places exposed to inundations, or where there is much stagnant water: and again, this disease produces the greatest ravages where the drinking water is brackish.

Thus, the Sologne, a plateau in the department of the Loiret, Loir et Cher, and Cher, is the chief of the marsh lands of France; it consists of vast ponds and valleys where it is difficult for the water to flow away, and which are easily transformed into marshes during the heat of the summer. Next in order come the departments bordering on the sea, also the marshes of the Dombes, La Bresse, and Breimé.

Again, charbon is known, not only in France, but in other countries of Europe which have marsh land. M. Verheyen says it is enzootic in Esthonia, Livonia, and Courland; also in Poland and several districts of Germany. Charbon, he remarks, appears every year, and by preference attacks those

animals which live in fields near the mouth of rivers, or where the ground is swampy.

In Spain charbon is enzootic in valleys which are under water at certain times, and in Siberia where there are innumerable lakes and swamps, the animals are decimated every year by "jaswa," or a charbon fever, which, in one year, killed about 100,000 horses.

The method adopted in many countries to counteract the influence of the marshes is to remove all flocks and herds to high plateaus in the mountains at the beginning of summer. It is well known that the soil of marshes is generally flint-clay, not permeable to the stagnant water, which covers its surface; they are, moreover, always more or less muddy, smelling most unpleasantly, and containing a number of aquatic plants, and much infusorial life; besides this, all marshes exhale carbonic acid and sulphuretted hydrogen.

The miasma produced is dependent upon the temperature, and thus during the months of July, August, and September, the marsh lands are the most unhealthy, and charbon is most likely to appear. When the bottom of the marsh is neither completely submerged nor completely dry, fermentation is easily induced, the conditions most favorable for the development of charbon result, and a septic substance is introduced into animals which either produces charbon, or some allied disease.—*Journal d'Hygiène*, vol. ii., No. 533.

RED COD.

In a report addressed by DR. HECKEL, of Marseilles, to the Ministre de la Marine (*Journal d'Hygiène*, vol. xi. No. 521, p. 462), he states that the loss to the fisheries and fish merchants by the prohibition of the use of "red" cod amounts to at least twenty million francs, and he has, after careful consideration, come to the conclusion that the red cod is not always poisonous, indeed it is so very rarely; it may become red without being poisonous, and he believes that the red color of the cod is due to a species of fungus. A Spanish newspaper, the *Imparcial*, of March, 1886, gives an account of the discovery in 1878, in the United States, of a red fungus in dried cod, which was ascribed by the commercial world to the use of Mediterranean salt for preserving. In 1884, Algiers seems to have suffered from the same disease, and the same year Béranger Férand stated that in Lorient 200 men out of 380 on board the "Vengeance" had been attacked after eating dried red codfish. The symptoms were the same as after partaking of any decomposed article of food—serious disturbance of the digestive apparatus and more or less disturbance of the nervous system. It is supposed to be due to a poisonous alkaloid, "ptomaine."

Several other accounts have been given of this poison or species of rust which is found in dried codfish, amongst them is a publication by Drs. LAYET, ARTYALES, and FERRÉ, of Bordeaux. They say that on the surface of dried codfish, affected in this manner, and between the muscles on the surface are organisms of a vegetable character which cause this reddish coloring. They take the form of "sarcinæ." They are found in heaps together with a granular substance, formed from remnants of tissue: they are most numerous near the crystals of salt, and they seem to penetrate with the salt in between the muscles and decompose the tissue.—*Deutsche Vierteljahrsschrift f. öff. Gesundheitspfleg.*, Bd. 18, No. 4, S. 633.

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